FIRST NOTIONS OF GEOGRAPHY

BY JOHN H. HAAREN

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FIRST NOTIONS OF GEOGRAPHY

BY

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SUPERVISOR OF SCHOOLS
OFFICE

FOR FOURTH-YEAR CLASSES

D. C. HEATH & COMPANY
BOSTON NEW YORK CHICAGO

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PREFACE

This little book treats of the fundamentals of geography, and is intended for pupils beginning the work of the fourth year in the elementary school course. The aim is to direct the child to the natural physical phenomena about him, to prepare him to read a map, to call attention to the unevenness of the earth's surface, to the work of water upon that surface, and to show that from the earth and the animals that live upon it are derived the materials for food, clothing, and shelter. All these particulars are presented in a suggestive rather than exhaustive manner, with a view to giving no more than can be readily acquired within the space of less than a year, with the usual provision in a course of study for the elements of geography.

Geography is a description of the earth as to surface, productions, persons, animals, and places, but with particular reference to man. The interest in geography comes directly from the fact that the earth is the home of man and that it ministers to his comfort and supplies his necessities.

Any text on geography would be unintelligible without illustrations, and the illustration peculiar to geography is the map. This little book lays the foundation for the study of the map by the lessons on direction and on the elevations and depressions of the earth's surface. The forces of nature, and the various phenomena connected with the sun, moon, and stars, are all closely related to geography, and cannot be overlooked in any presentation of that subject, however simple. The lessons on the materials which supply our food, clothing, and shelter are an introduction to that larger study of geography which reveals how nature and the forces of nature have been made to render service to man.

New York City J. H. H.
March, 1914

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FIRST NOTIONS OF GEOGRAPHY

I. OBSERVING THE WEATHER

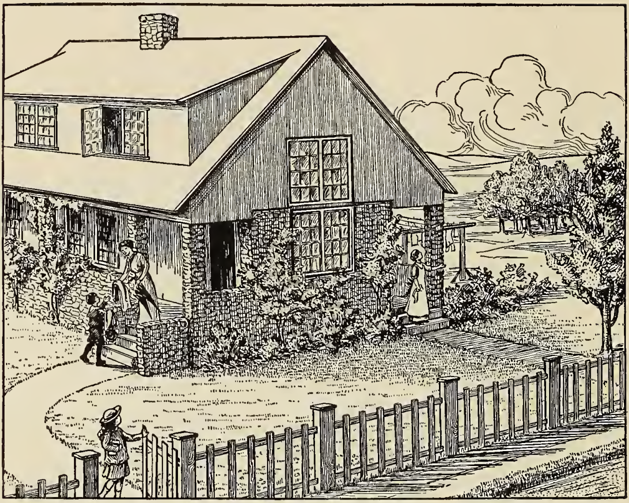
One bright morning in early fall, the children of Miss Smith's class were seated in their room ready for the work of the day. They looked ruddy and healthy, and the tan that had been put on their faces during the summer vacation was still plainly to be seen. As the sun tried to force its beams through the shaded windows, it lighted up all the room.

"How brightly the sun shines!" said Miss Smith to her pupils. "The air feels fresh, and the clouds are fleecy and beautiful. But there is something that makes me feel that there is to be a change in the weather. How many of you boys and girls looked at the sky and thought of the sun, the air, and the clouds on your way to school?"

All remained silent.

"Well, children," said Miss Smith at last, "I am afraid that while you felt the bright sunshine and the clear air, not many of you thought of noticing what kind of a day this really is."

One little boy, who lived outside of the village, raised his hand and said:



"Father said that it might rain to-day."

He remembered that his father usually took him home from school in a covered wagon when it rained.

"Why did he think it likely to rain, Frank?" asked the teacher.

"He said that he did not like the look of the clouds, and that the wind was just right for rain."

"And so it is," said the teacher. "If you had looked at the weather vane that you see every day, you would have noticed that the arrow points to the letter *E*, showing that the wind is from the east; and if you had looked at the sky, you would have seen that there are many heavy clouds in it."

Just then the light faded from the class-room, but in an instant all was bright again.

"There!" exclaimed several voices in a chorus. "That was a cloud shutting out the sun!"

"Yes, and those who started out this morning without looking at the sky, or without noticing which way the wind was blowing, may be caught in the rain. But there are other signs by which we may tell beforehand that it is likely to rain."

"Grandma says she knows it is going to rain when her rheumatism gets worse," said Mabel.

"And Uncle, who is an old soldier, says his wound pains him just before a rain," said Robert.

"Mother's neuralgia gets so bad sometimes that she has to go to bed, and then she says it is going to rain," added Mary.

"I have heard our hired man say that the moon looks watery before a storm. What does he mean by that, Miss Smith?" asked William.

"When the moon looks watery, there is a thin cloud before it, which dims the light, but does not hide it."

"I read in the paper yesterday that the barometer was falling. What does that mean? I looked at our barometer, but the cloudy part in it was rising."

"The barometer that you read of in the paper is not the kind that you usually see in people's houses. I will show you the kind that the newspaper referred to, when we get further on in our study of the weather."

"We have a barometer in our house," said Katie, "and a little man comes out with an umbrella over his head when it is going to rain."

"Barometers like yours and the one that William has at home," said the teacher, "are easily read. But I want you merely by looking at the sky and the things around you, to try to discover the kind of weather we are likely to have. I am going to keep a record of the weather from what you will tell me. This is the form I shall use:

MONTH . . . . *YEAR* . . . .

Day and Date.	*Sky.*	*Wind.*	*Weather.*	*Temperature.*

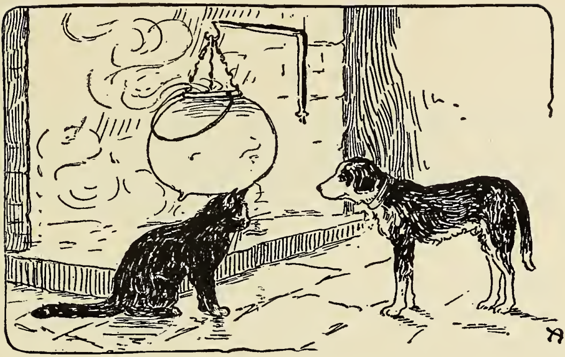
"You see that there are five columns, and enough lines for all the days in the month. At the top of the sheet we will write the name of the month. In the first column, we will write the day of the week and of the month. In the column under the word 'Sky' we will write *Clear*, *Hazy*, *Cloudy*, or *Overcast*. In the column under the word 'Wind' we will write the direction of the wind, after I have taught you how to tell the different points. In the column under the word 'Weather' we will, as the case may be, write *Fair*, *Threatening*, *Rain*, *Fog*, *Hail*, *Snow*, *Frost*, or *Dew*.

"The temperature we will find out from our thermometer. I will take the thermometer down from its place on the wall, and put it outside, for the temperature of the room will not help us in our study of the weather. When you can tell direction, you will see that the thermometer faces north. It must be sheltered from the sun, and so placed as not to touch the wall.

"I hope that when I ask to-morrow morning how many of you have observed the sky, I shall get a great many answers, so that we may begin at once to make a record of the weather."

SIGNS OF RAIN

The hollow winds begin to blow,
The clouds look black, the glass is low,
The soot falls down, the spaniels sleep,
The spiders from their cobwebs peep;
Last night the sun went pale to bed,
The moon in halos hid her head;
The boding shepherd heaves a sigh,
For see, a rainbow spans the sky:
The walls are damp, the ditches smell,
Closed is the pink-eyed pimpernel.
Hark how the chairs and tables crack!
Old Betty's joints are on the rack;
Loud quack the ducks, the peacocks cry,
The distant hills are seeming nigh.
How restless are the snorting swine;
The busy fly disturbs the kine;
Low o'er the grass the swallow wings,
The cricket, too, — how sharp he sings!
Puss on the hearth, with velvet paws,
Sits wiping o'er her whiskered jaws.
Through the clear stream the fishes rise
And nimbly catch the incautious flies.
The glow-worms, numerous and bright,
Illumed the dewy dell last night.
At dusk the squalid toad was seen,
Hopping and crawling o'er the green;
The whirling wind the dust obeys,
And in the rapid eddy plays.



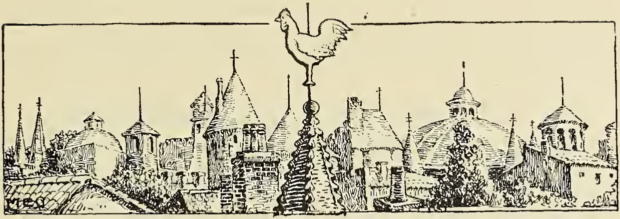
The frog has changed his yellow vest,
And in a russet coat is dressed.
Though June, the air is cold and still,
The merry blackbird's voice is shrill.
My dog, so altered in his taste,
Quits mutton-bones on grass to feast;
And see yon rooks, how odd their flight,
They imitate the gliding kite,
And seem precipitate to fall,
As if they felt the piercing ball.
'Twill surely rain, I see with sorrow,
Our jaunt must be put off to-morrow.

— *E. Jenner*

II. DIRECTION—THE WEATHER VANE AND THE COMPASS

Miss Smith's school was situated in the outskirts of a large city. The houses around were pretty cottages with pleasant grounds. The streets were not paved, but the sidewalks were laid, as well as crossings from one block to another. Not far from the school was a line of cars which daily took to their work and brought home again those who were employed in the city. A short walk led into the country, where the houses became fewer and fewer, until a number of pretty farm gardens were reached. Beyond these were farms of larger size, in which the corn bent to the passing breeze, rows of cabbages nestled on the ground, fields of oats, barley, and other grains waved to the friendly wind, and the leaves of the many fruit trees rustled as though gossiping with each other. The children were thus fortunate in enjoying most of the advantages of city life with the pleasures of the country so near at hand.

On coming to school the morning after the first lesson on the weather had been given, the pupils were quite ready for the next lesson. The teacher's



questions were readily answered, for the children had taken advantage of the walk to school to make observations. And so the weather record was begun.

"I am well pleased with the result of our first lesson," said the teacher. "You have used your eyes to good advantage, and I will begin at once the lesson on direction.

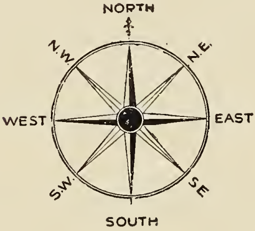
"On your way to school you must have noticed on the steeple of the church that stands back a little from the street, an arrow that points sometimes one way and sometimes another. You know what it is called, do you not, Robert?"

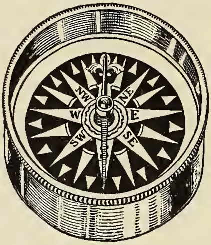
"Oh! that's a weather vane, and it shows the way the wind blows. There are four letters, *N*, *E*, *S*, and *W*, at the ends of rods that cross each other."

"Of course you know that the letters stand for North, East, South, and West. When the arrow points in the direction of the letter *N* the wind is blowing from the north, and is called a north wind, and so on for the other letters."

"All vanes do not have letters," said Henry; "I saw one the other day that had an arrow and nothing else."

"The best vanes have the points of direction, or, as they are usually called, the points of the compass, somewhere around the vane, even though not seen by the people that pass by. The points of the compass are sometimes marked on the ceiling of a high building right underneath the vane. But we must learn to determine the points of the compass for ourselves, and without letters or other marks."





"Father has a compass hanging to his watch chain," said Walter, "but I can't tell anything from it. He said he would teach me some day."

"If you look at the compass closely, you will notice a little arrow that moves on a pivot. When the compass is held on a level, with the face upward, the arrow always points the same way; that is, to the north. To find the other points you have to turn the compass until the arrow is in the same direction as the letter *N*, or some mark that stands in place of it."

"I didn't think that father needed his compass to tell the way the wind blew," said Walter.

"I don't think he does," replied the teacher. "The compass is used only to find out direction. The proper places to put the letters *N*, *E*, *S*, and *W* on the vane, were found by means of the compass. When Frank's father said yesterday that the wind was in the wrong quarter for a fine day, I do not think that he looked either at the weather vane or the compass. He *knew* direction. I want you to know direction, so that you will not need to look at the compass, but will be able to tell the north, east, south, and west from the signs around you."

WHAT THE WINDS BRING

Which is the wind that brings the cold?
The north-wind, Freddy, and all the snow;
And the sheep will scamper into the fold
When the north begins to blow.

Which is the wind that brings the heat?
The south-wind, Katy; and corn will grow,
And peaches redden for you to eat,
When the south begins to blow.

Which is the wind that brings the rain?
The east-wind, Arty; and farmers know
That cows come shivering up the lane
When the east begins to blow.

Which is the wind that brings the flowers?
The west-wind, Bessy; and soft and low
The birdies sing in the summer hours
When the west begins to blow.

— *Edmund Clarence Stedman*

III. DIRECTION — THE CARDINAL POINTS

"The class may rise." All rose in obedience to the teacher's command.

"*Face to the left!*" All did so.

"First and third rows, *right about face!* All, *left face!* Now I want you to notice that you are not all facing in the same direction. In obeying the command '*left face*,' the first and third rows turned to my left, while the second and fourth rows turned to my right — two opposite directions. *Front! Take seats!*"

This little exercise was very pleasant for all the pupils, but a few were wondering whether or not the teacher had forgotten the lesson on direction which she had promised the day before. They soon found, however, that the lesson had begun and that the exercise was a very important part of it.

"When you came to school this morning, Harry," said Miss Smith, "where did you see the sun?"

"On my left."

"And you, Mary?"

"On my right."

"Then what was Harry's left was Mary's right. How do you account for that, Walter?"

"Harry and Mary were going in opposite directions," answered Walter.

"On which side of the path leading from the street to the school is the great elm tree, children?"

Some said, "On the right"; others, "On the left."

"You are both right, and wrong," said the teacher. "When you are coming to school, the elm tree is on your right, and when you are going home, it is on your left. So the words 'right' and 'left' do not give a clear idea of direction. The words which ought to be used to indicate direction are those we used yesterday, — north, east, south, and west. Had I told you to face the east when some of you were facing one way and some another, you would all have turned to face in the same direction, if you had known where the east is. In coming to school, Robert saw the sun on his left and Mary saw it on her right, yet they both saw it in the east. Some of you say the elm tree is at the right of the path, and others say it is at the left. I should not know where the tree is from your way of telling me, unless I knew the direction in which you were going. But if you had told me that the tree is south of the path, you would not need to tell me the direction in which you were going. Now, perhaps, you begin to see how important it is to know the points of the compass."

THE COMPASS

Balanced on a point so fine,
Trembling at the slightest jar,
Steadily do I incline
Towards my bright polar star.

Rude hands may attempt to veer me,
From my bearings turning me,
But again to north I steer me
When to hasten back I'm free.

Stars may hide from human seeing;
As the sailor sails the sea,
In the longing of my being
For my star, he blesses me.

I feel where my star is shining
Though the night be dark and drear,
But himself to me resigning,
Knows the sailor's heart no fear.

IV. HOW TO TELL DIRECTION

Shortly before noon recess the next day Miss Smith said to her pupils:

"You have been wondering whether or not we are going to have our lesson on direction. We will have it this afternoon. Before beginning it, I want you all to observe very carefully your shadows as you go home. Those who have brought their luncheon may go to the flag-pole in front of the school and look at the direction of the shadow which the pole casts. I should like to have it marked in some way."

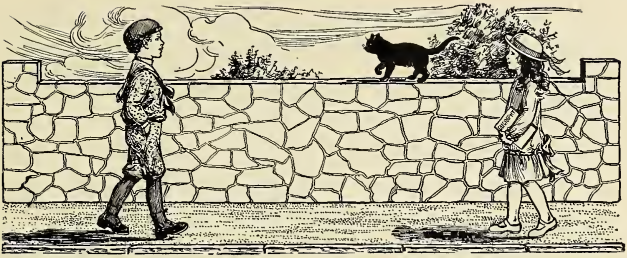
When school assembled in the afternoon, all were eager to tell what they had observed about shadows.

"Well, Rachel, what have you to say?" asked the teacher.

"I could not see my shadow unless I turned around. It was always behind me. The sun shone right in my eyes, so I turned around very often," replied Rachel.

"Where did you see your shadow, James?"

"Right in front of me all the time, but it was shorter than I am."



"George, what did you notice about your shadow?"

"It was short, too, and it kept in front of me until I came to the road that leads to our house. Then when I looked to my right, there was the shadow walking alongside of me."

"Philip went off with you, I noticed. What about your shadow, Philip?"

"When George and I parted, I turned to the right, and my shadow was at my left."

"I am sure," said the teacher, "that all of you can now tell me something about your shadows. The school was dismissed at noon, or twelve o'clock, and at that time the sun was in the south, and nearly overhead. Now let us go out and look at the shadow cast by the flag-pole, and we will finish to-day's lesson in the yard."

The class went out quietly and took places near the flag-pole.

"Here is the shadow," said the teacher.

"It has moved," said Harry, who had brought his lunch to school, "for the shadow was here when I looked at it. I marked the place with this line. The shadow has grown longer, too."

"I do not need to tell you that the shadow moves because the sun seems to move from one place in the sky to another. Harry's line runs north and south; I will cross it with this line. There! I have fixed the four points as you will find them on the compass. The point nearest the sun is south; we will mark it *S*. The opposite end is north; let us put the letter *N* there. Now, all of you face north. At your right hand will be the east, and at your left the west. See, I will mark the ends of the line I drew, *E* and *W*. Now, let us see how our schoolhouse is placed. All face north once more. How many can tell me on which side of the road the school is? Think well of all the points of direction."

All seemed to know that the school was east of the road.

"Which way does it face?"

"West!" all said together.

"When you are dismissed, in what direction do you go to reach the street?"

"West!" came as before.

"Now, I want you to tell me to-morrow the direction you take both in going home and in coming to school. Use the words north, east, south, and west, instead of the words right, left, and so on, which you have been using. Then if you show that you understand the lessons as far as you have gone, I will tell you other interesting ways of finding direction."

MY SHADOW

I have a little shadow that goes in and out with me,
And what can be the use of him is more than I can
see.
He is very, very like me from the heels up to the
head,
And I see him jump before me when I jump into
my bed.

The funniest thing about him is the way he likes
to grow —
Not at all like proper children, which is always very
slow;

For he sometimes shoots up taller, like an India-rubber ball,
And he sometimes gets so little that there's none of him at all.

He hasn't got a notion of how children ought to play,
And can only make a fool of me in every sort of way.
He stays so close beside me, he's a coward you can see;
I'd think shame to stick to nursie as that shadow sticks to me.

One morning, very early, before the sun was up,
I rose and found the shining dew on every buttercup;
But my lazy little shadow, like an arrant sleepy-head,
Had stayed at home behind me and was fast asleep in bed.

— *Robert Louis Stevenson*

V. HOW TO TELL DIRECTION—PRAIRIE AND FOREST

A few mistakes were made by the pupils the next day in describing the direction which they had taken in coming to school, but altogether Miss Smith was satisfied with the progress made. She gave some exercises in indicating direction, such as pointing to the north wall of the class-room, the south wall, and the walls at the other two cardinal points, and finally with a piece of chalk she marked an arrow on the floor.

"We shall always make sure of our direction while in the class-room," said she, "by looking at the way the arrow points. I want you to learn well the direction of the streets that are in the neighborhood, so that you will not have to depend upon the sun."

"I read in a book the other day," said William, "that a party out on the prairie found their direction by looking at a watch. How was that done?"

"Very easily," answered the teacher; "the watch was turned around till the hour hand pointed to the sun. Then the south lay in a direction halfway between the hour hand and the figure twelve on the watch." As she spoke she drew a sketch on the blackboard.

"But suppose," she added, "that the party had been in the woods or the day was cloudy?"

A little fellow here raised his hand.

"Father and I lost our way in the woods the other day, and he looked at the trunks of the trees, for the moss grows thickest on the north side of them."

"That is right," the teacher said. "Another way of finding direction, I have kept for to-morrow."

THE STARS

They glide upon their endless way,
Forever calm, forever bright;
No blind hurry, no delay,
Mark the Daughters of the Night:
They follow in the track of Day,
In divine delight.

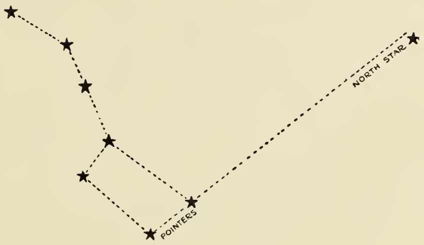
Shine on, sweet orbèd Souls for aye,
Forever calm, forever bright;
We ask not whither lies your way,
Nor whence ye came, nor what your light,
Be — still a dream throughout the day,
A blessing through the night.

— *Barry Cornwall*

VI. OTHER WAYS OF TELLING DIRECTION

As the sun is our timepiece and our compass in the daytime, so we turn to the stars at night. By looking carefully in the heavens you may see a group of seven stars, called from its shape the Great Dipper.

Three stars look like the handle of a dipper and four stars may be considered as forming its cup; the two stars farthest from the handle and forming the side of the cup are called the pointers. If a line could be drawn through these two stars, and extended some distance in the direction leading from the bottom to the top of the dipper, it would soon meet another bright star. This star is called the north star, and when you face it you are facing north.



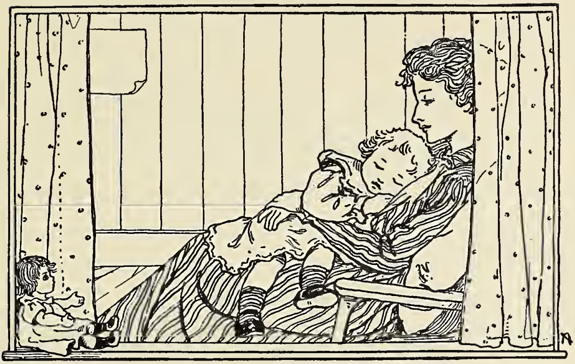
When the stars are not shining, the traveler must rely on his compass. In the forest, he must feel the trunks of the trees, if he be not provided with a compass. The Indian or the hunter is able to find his way through the woods on the darkest night, by feeling for the moss on that part of the trunks which faces the north.

"You will remember that our lessons on direction were first taken up that you might tell the direction of the wind. Our weather record was not complete till you had learned this. But suppose you lived in a place where you could see no vanes to tell the way the wind blows. What would you do then?"

"The flags flying from the buildings would tell me," said one pupil.

"I would know from the smoke coming from the chimneys," said another.

"But sometimes the wind does not blow hard enough to bend trees: it only makes the leaves quiver," said the teacher. "And you cannot always feel the wind, when it is so gentle. I think the simplest way is to watch the direction of the smoke from the chimneys. Yachtsmen keep their eyes on the pennant at the masthead when they are watching the wind. But if I tell you too much at one time, you will not remember it all."



SWEET AND LOW

Sweet and low, sweet and low,
Wind of the western sea,
Low, low, breathe and blow,
Wind of the western sea!
Over the rolling waters go,
Come from the dying moon, and blow,
Blow him again to me;
While my little one, while my pretty one, sleeps.

Sleep and rest, sleep and rest,
Father will come to thee soon;
Rest, rest, on mother's breast,
Father will come to thee soon;
Father will come to his babe in the nest,
Silver sails all out of the west
Under the silver moon:
Sleep, my little one, sleep, my pretty one, sleep.

— *Tennyson*

VII. FINDING AND ESTIMATING DISTANCES

When the weather record had been kept for a month, the teacher said that a summary should be made. The clear days were counted, as well as those that had been cloudy or overcast. The days on which the wind had been in the east were counted, as well as the days when the wind had blown from other points. The weather column was studied to find out what wind accompanied each change of weather, and the temperature column was compared with both the wind and the weather column. Then the pupils added the numbers in the temperature column, and divided the sum by the number of days recorded. The teacher said that the quotient was called the *mean*, or *average*, temperature.

"Now," said she, "I do not think our summary would be complete, unless we measured the shadow of the flag-pole. You may do this at noon. Hereafter we will measure it once a week.

"I have a yardstick. Can you tell me how long it is?"

"Three feet," said several.

"That is right. While I hold the stick in my hand, I would like John to go to the board and draw a line a foot long."

After taking a glance at the ruler on his desk, John went to the board and drew a line.

"Now, measure off six inches." John did so.

"You may take your seat. The class will now take pads and draw three lines, one six inches long, one three inches long, and one four inches long. Measure the lines with your rulers.

"Now measure the length of the desk. The width of the desk.

"I shall place a mark here on the floor. William, toe the mark, and take a step, an ordinary step. How long a step did you take? Measure with your ruler. Pace the length of the room, and the width. How many feet long is the room? How many feet wide?

"Mary, you may measure the blackboard. What are its dimensions, — that is, its length and height?

"The class will now estimate the height of the door. Write your estimate on your pads, while I measure with the yardstick and see how near right you are.

"I have here a tape-line which is a hundred feet long. It is marked off into feet and inches. While some of you are measuring the shadow of the flag-pole at noon to-day, some of you may take the length and width of the school-house.

"People sometimes roughly estimate distances by pacing, or counting the steps they take. If you think you can remember the number, you may count the steps you take on your way home. Then if you know how long a step you take, you can tell very nearly the distance you travel."

Short distances only are measured by feet and yards. For longer distances the measure is taken in miles.

You know from the table of measures that there are 5280 feet in a mile. A full-grown man can take a yard at each step, so in 1760 steps he can cover a mile.

Some bicycle riders have *cyclometers* by which they are able to tell the distance they travel. As soon as a mile, or some certain part of it, has been traveled, the distance is indicated.

When you are out for a walk, it is a good plan to estimate the heights of the houses, trees, and steeples that you see, as well as the distances over which you travel. In cities, streets running in the same direction are usually of the same length, so if we know the length of the block or square, we can calculate how many of them make a mile, and thus tell how far we travel.

VIII. MEASURING A SHADOW

The length of the shadow cast by the flag-pole in the school yard at noon was found to be four feet.

"That is a very short shadow for so long a pole," said the teacher.

"Shadows at noon are always short," said one of the pupils. "The other day when you told us to watch our shadows as we went home to lunch, I couldn't find mine at all till I looked close at my feet."

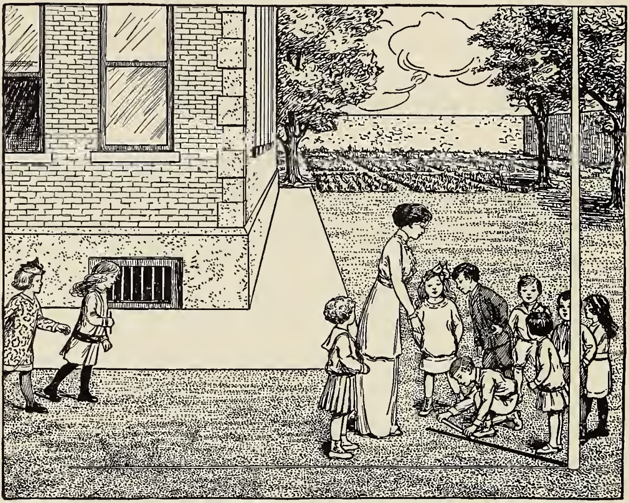
"Shadows are longer in winter," said Mabel.

"So they are in the morning and afternoon," said William.

"I want you to notice," said the teacher, "that when the sun casts long shadows, we do not feel its heat so much. The reason for this you will learn later. But the study of the shadow is interesting. When you passed through the street on your way to school this morning, Henry, on which side did you walk?"

"On the east side, for the sun was quite strong, and I was glad to walk in the shade."

"When you go home this afternoon, on which side do you think you will walk?"



"The west side is shady then, so I shall go there."

"It will, I think, be interesting for you to study the journey of the shadow of our flag-pole for a day as it passes from west to east, growing shorter as noon approaches, and longer again as the afternoon advances. I will appoint some of you to go out and mark the shadow every half hour from nine o'clock till three to-morrow. You may study the marks for yourselves, and I think you will find enough to talk about."

SHADOW

It falls before, it follows behind,
Darkest still when the day is bright;
No light without the shadow we find,
And never shadow without the light.

From our shadow we cannot flee away;
It walks when we walk, it runs when we run;
But it tells which way to look for the sun;
We may turn our backs on it any day.

Ever mingle the light and shade
That make this human world so dear;
Sorrow of joy is ever made,
And what were a hope without a fear?

A morning shadow o'er youth is cast,
Warning from pleasure's dazzling snare;
A shadow length'ning across the past,
Fixes our fondest memories there.

One shadow there is, so dark, so drear,
So broad we see not the brightness 'round it;
Yet 'tis but the dark side of the sphere
Moving into the light unbounded.

— *Isa Craig Knox*

IX. DRAWING TO A SCALE

"To-day," said Miss Smith, "I intend to teach you something about plans. If I want a carpenter to make a table or other piece of furniture I must furnish him with a drawing or plan, in order that he may make just what I desire. A builder must also have a plan of the house he is going to build. The drawing, or plan, gives the idea of what is wanted. Suppose you take your rulers and measure the length and breadth of your desks. What is the length of your desk, James?"

"Twenty inches," replied James.

"I will draw on the blackboard a line twenty inches long. Here it is. What is the width of your desk?"

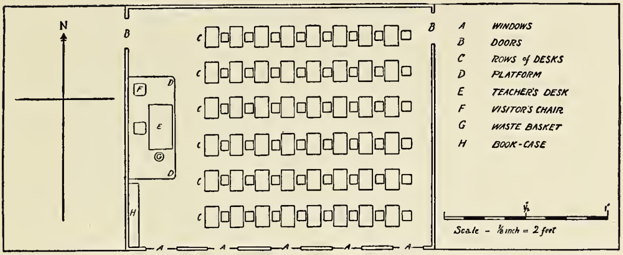
"Sixteen inches."

"Very well. Copy these lines exactly on your pads."

Several hands were raised in a moment.

"Our paper is not large enough!" a number of children exclaimed, when the teacher indicated permission to speak.

"Of course you see that to draw a full-sized plan of the top of your desk, you would require paper at



least twenty inches long. So a builder would need to have plans the size of the house he is to build. This would be very troublesome. Can any one tell me how this trouble is avoided?"

"By using a scale," said John.

"Do you know what is meant by that, John?" asked the teacher.

"On the plans I saw were the words, 'Scale, an inch to the foot'," he replied, "but I did not understand what that meant."

"We shall find out the full meaning of those words before the lesson is over," said the teacher. "Now suppose we draw the plan of your desk-top, using lines one-fourth of the measures you took. You said your desk is twenty inches long. To indicate the length draw a line —— "

"Five inches long," hastily said James.

"The width will then be —— "

"Four inches."

"Now you have drawn to a scale of one-fourth, that is, three inches to the foot. Indicate on your plan the inkwell, and any book or other object you may have on your desk. Let us go a step farther. Take the other side of your paper. James, please hold the tape-line while I go to the other end of the room. Be sure to keep the box close in the corner. How many feet does the line measure?"

"Thirty feet."

"Now, I will go in the other direction. Roll up the line as I go, James, because this wall is shorter than the other. Thank you, James. Now, give the line to William. What does it indicate now, William?"

"Twenty-four feet."

"The dimensions of the room are then thirty by twenty-four feet. Which wall is the longer?"

"The north wall."

"If I draw a line to indicate the north wall, on the scale of an inch to the foot, the line will be thirty inches long, that of the west wall will be twenty-four inches; the south wall is the same in length as the north wall, and the east wall will equal the west wall."

"But, Miss Smith, the walls are not running the way you have drawn them," a bright little fellow interrupted.

"Tell him why, Mary."

"Because our seats face west, and you put the north wall at the top."

"That is what is usually done in plans, unless an arrow is placed there to show where the north is," said Miss Smith. "Let us place the doors and windows where they should be. The doors are in the east and west walls, while all the windows are in the south wall. While William is measuring the width of the doors and windows, let Emma count the desks, and Susan measure the width of the aisles as well as the passage in the rear of the desks. What are your measurements, William?"

"Doors and windows are three feet wide."

"The aisles are two feet wide, and so is the passageway," said Susan.

"There are forty-eight desks, in six rows," added Emma.

"We will indicate all of these in our plan," said Miss Smith, "as well as my desk and chair, the extra chair, the bookcase, and the waste-basket. Let each of you now see if you can correctly locate on this plan your own seat and desk. We shall soon have a complete plan of our room and the furniture in it. There! now it is finished. To-morrow if you will take the proper measurements we shall draw a plan of the school-house and grounds."

THE CLOUD

I bring fresh showers for the thirsting flowers,
From the seas and the streams;
I bear light shade for the leaves when laid
In their noonday dreams.
From my wings are shaken the dews that waken
The sweet buds every one,
When rocked to rest on their mother's breast,
As she dances about the sun.
I wield the flail of the lashing hail,
And whiten the green plains under;
And then again I dissolve it in rain,
And laugh as I pass in thunder.

I sift the snow on the mountains below,
And their great pines groan aghast;
And all the night 'tis my pillow white,
While I sleep in the arms of the blast.
Sublime on the towers of my skyey bowers
Lightning, my pilot, sits;
In a cavern under is fettered the thunder, —
It struggles and howls at fits;
Over earth and ocean, with gentle motion,
This pilot is guiding me,
Lured by the love of the genii that move
In the depths of the purple sea;
Over the rills and the crags and the hills,
Over the lakes and the plains,
Wherever he dream, under mountain or stream,
The Spirit he loves remains;
And I all the while bask in heaven's blue smile,
Whilst he is dissolving in rains.

The sanguine sunrise, with his meteor eyes,
And his burning plumes outspread,
Leaps on the back of my sailing rack
When the morning-star shines dead.
As on the jag of a mountain-crag,
Which an earthquake rocks and swings,
An eagle alit one moment may sit
In the light of its golden wings;
And when sunset may breathe from the lit sea beneath
Its ardors of rest and of love,

And the crimson pall of eve may fall
    From the depth of heaven above,
With wings folded I rest on mine airy nest,
    As still as a brooding dove.

That orbèd maiden with white fire laden,
    Whom mortals call the moon,
Glides glimmering o'er my fleece-like floor
    By the midnight breezes strewn;
And wherever the beat of her unseen feet,
    Which only the angels hear,
May have broken the woof of my tent's thin roof,
    The stars peep behind her and peer;
And I laugh to see them whirl and flee,
    Like a swarm of golden bees,
When I widen the rent in my wind-built tent,
    Till the calm rivers, lakes, and seas,
Like strips of the sky fallen through me on high,
    Are each paved with the moon and these.

— *Percy B. Shelley*

X. VAPOR

Just as the children were about to begin their work one morning, a rainstorm started.

"Where does the rain come from?" asked Miss Smith, as soon as the storm began.

"From the clouds," was the answer.

"Where do the clouds come from?" she continued.

There was silence, but some of the pupils looked as though they had an idea of the answer.

"I can wait a while for the answer to that question," said Miss Smith, "and to help your thoughts to clear up, I will ask a few other questions. Why are clothes hung up on a line after they are washed?"

"To dry them."

"What becomes of the water that made them damp? Do not answer yet. Last night I left a few drops of water in this tumbler, but I found it dry this morning. As I passed through the street yesterday, I noticed that where the pavement had been washed, it was nearly dry. The stoop outside the school will not remain wet very long after the rain is over. Where does the water go in all these cases? You may tell, Harry."

"It must go into the air."

"Why do you think so?"

"Because I often see steam going up in clouds, and steam is nothing but water."

"How do you know that?"

"I held a slate over the spout of the tea-kettle."

"You might have noticed that the steam began not at the spout but at a very short distance from it. Now the steam must have passed through the space which appears clear. If you have looked closely at a locomotive when it is giving out steam, you must have noticed, particularly on a warm day, that the thick cloud of steam does not form until it is a short distance from the funnel or pipe. It is only when the steam gets a little cold that it can be seen.

"The wind helps water to evaporate, that is, to pass into vapor. You will notice that the side of a street exposed to the wind will dry up after a storm more quickly than the side that is sheltered from the wind.

"I shall let you think over these things before I ask you to answer the question, 'Where do clouds come from?'"

SCENE AFTER A SUMMER SHOWER

The rain is o'er. How dense and bright
Yon pearly clouds reposing lie!
Cloud above cloud, a glorious sight
Contrasting with the dark blue sky!

In grateful silence, earth receives
The general blessing; fresh and fair,
Each flower expands its little leaves,
As glad the common joy to share.

The softened sunbeams pour around
A fairy light, uncertain, pale;
The wind flows cool; the scented ground
Is breathing odors on the gale.

'Mid yon rich clouds' voluptuous pile,
Methinks some spirit of the air
Might rest, to gaze below awhile,
Then turn to bathe and revel there.

The sun breaks forth; from off the scene
Its floating veil of mist is flung;
And all the wilderness of green
With trembling drops of light is hung.

Now gaze on Nature — yet the same —
Glowing with life, by breezes fanned,
Luxuriant, lovely, as she came,
Fresh in her youth, from God's own hand.

Hear the rich music of that voice,
Which sounds from all below, above;
She calls her children to rejoice,
And round them throws her arms of love.

Drink in her influence; low-born care,
And all the train of mean desire,
Refuse to breathe this holy air,
And 'mid this living light expire.
— *Andrews Norton*

XI. WHERE RAIN COMES FROM

"You said, Miss Smith, that it is only when vapor gets cold that it is seen. I think then that all clouds are vapor that has become cold," said James.

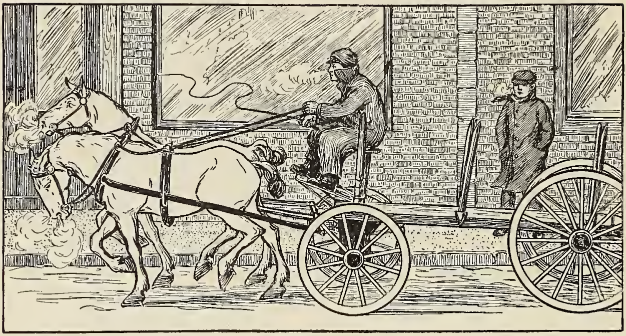
"And you are right," the teacher replied. "You will remember that on a cold day the steam from the locomotive is very thick and then it spreads and gradually disappears into the air."

"I have seen a spot of ground wet with the drops of water that came from the steam," said Annie.

"And so have I," said the teacher. "I have also felt a little dash of rain that came from the steam, when I sat near the steam pipe, on the hurricane deck of a steamer. But do not let us go ahead too fast.

"We know that when water evaporates, it is taken up into the air. The vapor is lighter than air, and so rises just like smoke.

"Warm air is very thirsty and can take up a great quantity of vapor. You will recall that on a dry and warm day the cloud from the locomotive disappears quite rapidly, while on a cold or damp day the cloud remains for some time sus-



pended in the air. There are some days on which clothes dry more quickly than on other days, but there are very few days on which evaporation will not take place to some extent.

"We breathe out moisture, and plants do the same. There is always some moist vapor in the air and, as we have seen, when this moist vapor is chilled it appears either as a cloud or as drops of water.

"When you are walking in the cold air, you can see your breath, as you say, for the moisture in it is chilled as you breathe it out.

"When I enter a warm room after having been in the cold air outside, my spectacles become so clouded that I cannot see through them. The glasses are very cold and they chill the warm moist air that is near them.

"In summer you must have seen the cloud that is formed on the outside of a glass containing ice-water."

"I have seen drops of water running down the outside of the water pitcher in summer," said Harry.

"And I have seen our kitchen windows so clouded on a wash-day in winter that you could not see outside," said Ella.

"I have seen the windows of a crowded car clouded in the same way on a rainy day in summer," said Miss Smith. "All these things help you to understand where clouds come from, so now I will call for the answer to my question, where do clouds come from? What do you say, William?"

"I think that clouds are chilled vapor, which a cold wind must have struck, so that we can see them."

"That is true in general, William, but vapor may be chilled when no wind is blowing; sometimes a cloud is formed when warm moist air strikes the side or top of a mountain. No matter in what way moist air is chilled it is condensed. It might be better to say that clouds are condensed vapor. You will remember, I hope, that vapor is condensed — that is, made thicker or heavier — when it is chilled. If the cloud be chilled still further, the moisture is formed into drops, and they fall as rain."

LITTLE WHITE LILY

Little white Lily
Sat by a stone,
Drooping and waiting
Till the sun shone.

Little white Lily
Sunshine had fed;
Little white Lily
Is lifting her head.

Little white Lily
Said, "It is good —
Little white Lily's
Clothing and food,"

Little white Lily
Dressed like a bride!
Shining with whiteness,
And crownèd beside!

Little white Lily
Droopeth with pain,
Waiting and waiting
For the wet rain.

Little white Lily
Holdeth her cup;
Rain is fast falling
And filling it up.

Little white Lily
Said — "Good again —
When I am thirsty
To have fresh rain!

Now I am stronger;
Now I am cool;
Heat cannot burn me,
My veins are so full."

Little white Lily
Smells very sweet;
On her head sunshine,
Rain at her feet.

"Thanks to the sunshine,
Thanks to the rain!
Little white Lily
Is happy again!"

— *George Macdonald*

XII. DEW

"Sometimes the ground is wet although no rain has fallen."

"That is the dew; I have often got wet feet walking in the grass early in the morning," said Mary.

"Dew falls late in the afternoon, too," added Frank.

"People speak of dew falling, as though it came down like rain," said the teacher, "but this is not correct. My glasses sometimes become clouded when I enter a warm room after being out in the cold air, because the cold glasses condense the moist vapor that touches them. The drops trickling down the outside of the ice-pitcher come from the moist vapor that is chilled when it touches the cold vessel. Dew does not fall any more than the drops fell on the pitcher, or the moisture fell on my glasses. You can see this for yourselves by noticing that frequently the under surface of a leaf is covered with dew, while the upper surface is perfectly dry. When the ground becomes cold, as it does even in summer when the sun does not strike it, the moist vapor in the air touches the ground, becomes chilled, and condenses, so that it can be felt. Where the ground is covered with grass, the heat received from the sun passes off quite rapidly, and the moist air is condensed and gathers in drops on the grass. But there are four things that I wish you to notice and remember in studying about the dew.

"First, dew is not readily formed on a cloudy night. The clouds prevent the ground from cooling off as quickly as on a clear night.

"Second, the ground is kept warmer where it is sheltered by a shed or an overspreading tree, and dew is not formed.

"Third, dew is usually formed only on still nights. If there is a wind, the vapor is carried away before it can condense into dew.

"Fourth, dew is deposited more readily on some bodies than on others. This is because some bodies part with their heat, or become cool, more readily than others. Thus the grass may be covered with dew while the gravel walk near it is perfectly dry. In large cities the houses and pavements do not readily give off their heat, and dew is seldom formed."

THE DEWDROP

Ah, be not vain. In yon flower-bell,
As rare a pearl, did I appear,
As ever grew in ocean shell,
To dangle at a Helen's ear.

So was I till a cruel blast
Arose and swept me to the ground,
When, in a jewel of the past,
Earth but a drop of water found.

— *Joseph Skipsey*

XIII. FROST AND SNOW

"Very often in winter the weather becomes mild after a cold spell. The air is quite warm and it holds considerable moisture. It is no strange sight to see the ground very damp from the dew that has been deposited. In fact, on the same morning, I have seen heavy dew and not far from it a space covered with what looked like fine snow."

"I know what that is called," cried Walter. "Hoarfrost!"

"Yes, or simply frost, and such little fine needles or crystals of ice may be formed by artificial means. Last summer, while in the city, I visited a cold-storage warehouse, and although the weather was very warm, some pipes leading to the cold storage, where the butter, eggs, and meats were kept, were so thickly covered with these crystals that I was able to take off enough to make a large snowball."

"Then snow comes from vapor too!" exclaimed Anna. "Please tell us how snow is formed."

"There is the same difference between frost and snow as between dew and rain. Rain and snow are both formed in the upper air of moist vapor. The great difference is that when snow is formed,

the air that condenses the moist vapor is much colder than when rain is formed.

"Frost was formed on the ground near the dew, because that place was so exposed that its temperature fell below the freezing point, or 32 degrees by our thermometer. Now, the current that strikes the moist vapor in the upper air must be colder than 32 degrees, in order to form snow instead of rain.

"I want you to look very closely at the flakes, when the first snow falls. You will notice that the flakes are all six-pointed figures, but of different shapes, hardly two of them being alike."

THE FROST

The Frost looked forth one still, clear night,
And he whispered, "Now I shall be out of sight,
So through the valley, and over the height,
In silence I'll take my way.
I will not go on like that blustering train,
The wind and the snow, the hail and the rain,
Who make so much bustle and noise in vain,
But I'll be as busy as they!"

Then he flew to the mountain, and powdered its crest;
He lit on the trees, and their boughs he dressed
In diamond beads — and over the breast
Of the quivering lake he spread
A coat of mail, that it need not fear
The downward point of many a spear,
That he hung on its margin, far and near,
Where a rock could rear its head.

He went to the windows of those who slept,
And over each pane, like a fairy, crept;
Wherever he breathed, wherever he stepped,
By the light of the morn were seen
Most beautiful things; there were flowers and trees,
There were bevies of birds and swarms of bees,
There were cities with temples and towers: and these
All pictured in silver sheen!

But he did one thing that was hardly fair —
He peeped in the cupboard, and finding there
That all had forgotten for him to prepare,
“Now, just to set them a-thinking,
I’ll bite this basket of fruit,” said he;
“This costly pitcher I’ll burst in three;
And the glass of water they’ve left for me
Shall ‘tchick!’ to tell them I’m drinking!”

— *Hannah F. Gould*

XIV. HAIL

"Besides rain and snow there is something else that falls from the sky."

The many hands that were raised, showed the eagerness of the pupils to tell what they knew.

"You all know that I refer to hail," said the teacher. "But can you tell me how hail is formed?"

"It is frozen rain," said Charles.

"The small grains of hail that sometimes fall in winter just before a snowstorm are probably raindrops that have been frozen as they fell. Many hailstones that fall in summer are as perfectly round and clear as a raindrop. But sometimes the stones are so large as to injure animals, and even people, very seriously. I have read an account of a hailstorm in which stones half the size of a brick drove the crew of a ship from the rigging. Stones as large as this, however, are generally supposed to be composed of several smaller hailstones frozen together.

"The great damage done by hailstorms is not always owing to the size of the stones, however. Their velocity — that is, the speed with which they fall — also causes great damage. Hailstones often fall at the rate of a mile a minute. They must have had a velocity as great as this in the famous storm which happened in Vienna, in June, 1894, when the windows in thousands of houses were broken by the hailstones. In some cases they passed through panes of glass, cutting holes as clean as those made by a bullet. Hailstones have been broken and found to contain some light fleecy snow imbedded in ice.

"Sometimes there are several layers of this ice, like coats of an onion. It would seem as though the stone had become wet and the moisture had frozen several times while coming down to us. But learned men have not agreed exactly as to how hail is formed in the upper sky. Now let me see whether you can recall some things in connection with the last hailstorm. You may answer, Susan."

"I think hailstorms occur only in summer," said Susan.

"They usually do," said the teacher, "but not always. We have seen that the fine hail sometimes precedes a snowstorm."

"I think I have read somewhere that hail falls in the daytime rather than at night," said James.

"A hailstorm brings on a thunderstorm," said Thomas.

"It very often occurs just before a thunderstorm," said the teacher, "but does not cause it. It is likely that both the hailstorm and the thunderstorm are produced by the same cause."

A FROSTY DAY

Grass afield wears silver thatch,
Palings all are edged with rime,
Frost-flowers pattern round the latch,
Cloud nor breeze dissolve the clime;

When the waves are solid floor,
And the clouds are ironbound,
And the boughs are crystall'd hoar,
And the red leaf nail'd aground.

When the fieldfare's flight is slow,
And a rosy vapor rim,
Now the sun is small and low,
Belts along the region dim.

When the ice-crack flies and flaws,
Shore to shore, with thunder shock,
Deeper than the evening daws,
Clearer than the village clock.

When the rusty blackbird strips,
Bunch by bunch the coral thorn,
And the pale day-crescent dips
New to heaven a slender horn.

— *De Tabley*

XV. THE CIRCULATION OF WATER

"All the water and the moisture in plants, animals, and in everything around us is continually passing off into the air, and coming back to the earth again as dew, rain, frost, snow, and hail. Cold air does not take up moisture as readily as warm air. But even ice will evaporate without melting if left long enough. You have noticed that hoarfrost, which is nothing but ice crystals, will disappear without melting. Of course if it melts, it will disappear the more quickly. We say that it will disappear, but we know that it evaporates, or goes into the air as vapor. It is present in the air though it does not appear to us.

"Vapor is usually invisible, but we sometimes see it suspended in the air as cloud, fog, or mist.

"In the *cloud*, the very fine particles of moisture, sometimes called water-dust, are slightly condensed. In the *fog*, they are somewhat more condensed; and when the particles of water-dust in the fog unite, a *mist* is the result. Fogs and mists, then, are nothing more than low clouds.

"The *haze* that we sometimes see is not formed of particles of water, but of very fine particles of dust

floating in the air. Moisture sometimes gathers around these dust particles, and thus they may help to form clouds and fogs.

"Very often a fog may rest on a river, while the air over the land on its banks is perfectly clear. This may happen when the air over the river is either warmer or colder than the river itself. If the air over the river happens to be warmer than the water, the water will chill the air, and a fog will be formed just as a cloud was deposited on the spectacles, as we have seen before. If the air over the river is colder than the water, the water may give out more vapor than the air can take up, and the vapor will be condensed.

"The amount of vapor that the air can take up depends upon the temperature of the air. Warm air can take up more vapor than cold air. Each degree of temperature has its *dew-point*, and when the dew-point has been reached, the air is said to be *saturated*, that is, it has all the moisture it can hold at that temperature. If the air gets warmer, more moisture can be taken up, but if the air gets colder, the moisture is condensed to form rain, snow, or hail."

THE BROOK

I come from haunts of coot and hern,
I make a sudden sally,
And sparkle out among the fern,
To bicker down a valley.

By thirty hills I hurry down,
Or slip between the ridges,
By twenty thorps, a little town
And half a hundred bridges.

Till last by Philip's farm I flow
To join the brimming river,
For men may come, and men may go,
But I go on forever.

I chatter over stony ways,
In little sharps and trebles,
I bubble into eddying bays,
I babble on the pebbles.

With many a curve my banks I fret
By many a field and fallow,
And many a fairy foreland set
With willow-weed and mallow.

I chatter, chatter, as I flow
To join the brimming river,
For men may come, and men may go,
But I go on forever.

I wind about, and in and out,
With here a blossom sailing,
And here and there a lusty trout,
And here and there a grayling,

And here and there a foamy flake
Upon me as I travel,
With many a silvery waterbreak
Above the golden gravel,

And draw them all along and flow
To join the brimming river,
For men may come, and men may go,
But I go on forever.

I steal by lawns and grassy plots,
I slide by hazel covers,
I move the sweet forget-me-nots
That grow for happy lovers.

I murmur under moon and stars
In brambly wildernesses;
I linger by my shingly bars;
I loiter round my cresses;

And out again I curve and flow
To join the brimming river,
For men may come, and men may go,
But I go on forever.

— *Tennyson*

XVI. FINDING THE SOURCE OF THE BROOK

"Our last lesson was upon the circulation of water, but we only considered its circulation between earth and air. An important part of the work of water is done in its circulation on the earth itself. To begin this part of our subject, I shall take you on a little excursion, and we will study our lesson while roaming over the hills, and gathering the leaves that just now have such beautiful color. You may put on your wraps, and we will start on our tour."

As the schoolhouse was on the outskirts of the city, the teacher led her pupils past lawns and gardens until they came to fields and meadows from which the crops had been gathered. By and by the merry party came to a brook that ran swiftly along, full of water.

"Where does all this water come from?" asked the teacher, leaning on the rail of the bridge and looking upstream.

"It comes from a spring near our pasture," said Robert.

"The brook that comes from your spring only flows into this one," said James: "this begins up in the hills."

"Let us walk along the side of the brook, and see for ourselves where it begins," said the teacher, "and as we go on let us notice the various things the brook carries with it. If you look closely you will see that the water is quite muddy. What makes it so?"

"The brook is always muddy after a rain," said George.

"But why is it muddy?" asked the teacher.

"Because it has a lot of dirt in it," answered Mary.

"Let us not call it dirt," said the teacher, "it is nothing but the loose soil and the substances taken up on the way! But does the water remain muddy?"

"Oh no! after a time it clears up," said Anna.

"How does it clear up?"

"It settles; that is, the sand and soil sink to the bottom."

"Yes," said the teacher; "just as when your mother finds that the first cup of coffee that she pours out at breakfast is muddy, she lets the coffee settle. But the twigs and leaves and other light bodies do not settle. They float until they reach the ground on either side, or some other body. But here is where the brook from Robert's spring

empties into our large brook. Now, where does the water in the spring come from?"

"It comes right out of the ground," said Robert.

"But the ground does not produce water," said the teacher. "We may find the answer to this by and by. Let us not walk too fast, for I am getting out of breath. We have been walking up hill all the time. Why does not the grass grow on the sides of the brook?"

"Because the water is always washing the ground away," said William. "That is what makes the brook muddy."

"Not only that, but every little stream that flows into the brook brings its share of soil with it. This little rill is quite clear, but see how slowly it flows. Here is another, but it is more rapid and quite muddy. Now we are nearly at the top of the hill. Look out, or you will wet your feet. You see that, though the sun is shining, it has not dried up the little threads of water here and there."

"The grass protects them," said Charles.

"And the trees as well. There are so many of these threads of water that we have some difficulty in following them. Here we have the source of the brook. All the land over which the little streams flow into the brook, is called the basin of the brook. When the rain falls, some sinks into the ground, and some collects in little pools, or is caught by the grass. Some is evaporated, but what is caught by the grass flows here and there wherever a passage is free, being once in a while turned aside by a pebble or a little tuft of grass. The water that sinks into the earth goes down till it is stopped by some substance through which it cannot pass. Then it flows along the substance, being joined by other little streams just as our little rills here were joined, until it finds an outlet. Then it flows out, and we call it ——"

"A spring!" said Robert.

THE BROOK AND THE WAVE

The brooklet came from the mountain,
As sang the bard of old,
Running with feet of silver
Over the sands of gold!

Far away in the briny ocean
There rolled a turbulent wave,
Now singing along the sea-beach,
Now howling along the cave.

And the brooklet has found the billow,
Though they flowed so far apart,
And has filled with its freshness and sweetness
That turbulent, bitter heart!

— *Longfellow*

XVII. A RIVER SYSTEM

"The brook is fed by smaller streams directly, or by springs into which is gathered the water that somehow has soaked through the soil. Both the streams and the springs are fed by the rain.

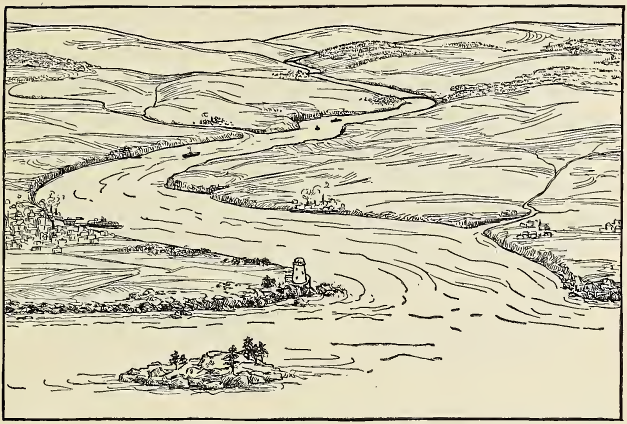
"The brook rushes on where the slope is steep, and takes with it whatever it can, part of the soil or grains of sand, and when the rush is very swift, pebbles and stones may be taken up or rolled along. The edges of these pebbles and stones are worn off after a while, and in brook and river bottoms we often see some of them worn almost perfectly round.

"The brook passes away, and as it flows down and is joined by other brooks, it is known as the creek. But what becomes of the creek?"

"When I went rowing on the creek one day with my cousin we went down very far until we came to the river. There I saw sailboats, and two or three large schooners at a dock," said James.

"Did your cousin tell you where the river goes to?" asked the teacher.

"Yes; he lives in the city, and he came up the river in a large steamboat. The steamboat was at



the dock, too, and I saw it there. It was much larger than our house. It had three stories."

"Decks," said the teacher.

"Yes; decks. He said that the second deck had over a hundred little bedrooms — staterooms, he called them — and he had slept in one on the way up."

"How deep and wide the river must be, to let such a large vessel through! But did your cousin tell you anything about the river itself?"

"Yes; he said that the water in it was very salt, and that it flowed down into a bay — that is where it widened — and then it flowed into the ocean."

"Now," said Miss Smith, "let us look back a moment over all this. Our little brook flows down, and is joined by other brooks; then they all flow into the creek, and the creek flows into the river. Many other creeks, of course, flow into the river at other places. The river widens into the bay, but only sometimes, for occasionally rivers flow directly into the sea or some other large body of water.

"Now, it is from the ocean that the great part of the vapor comes that forms our clouds. The vapor that rises into the air from our breath, from plants, from clothes hung out to dry, from the steam of engines, from the rain that dries on the earth, and from the streams on the land, gives only a small part of what falls as rain. We know this because places that are far away from the sea, or that are cut off by high mountains from the clouds that come from the sea, do not have much rain.

"The sea gives us water in the form of clouds, and the earth gives back to the sea again most of the water that it received as rain and snow.

"We have been describing a river system; that is, a river with all the streams that flow into it. The land thus drained is called the basin or valley of the river. A river system may have rivers hundreds of miles long, and the main river may have flowing into it rivers nearly as large as itself.

"This leaf that I hold in my hand may give us some idea of a river system. The main stem we

will call the principal river. On both sides of it are other stems, and these stems have branches on each side forking off into still smaller veins.

"If you could get high enough above the earth, and if you had eyes sharp enough, you might see on the earth river systems that are very like the stems and veins of this leaf.

"When we return to school, I am going to have you draw a plan or, rather, a map of our journey to-day, and I will ask you as well to sketch out your idea of a river system."

THE ALTERED RIVER

Thou lovely river, thou art now
As fair as fair can be;
Pale flowers wreathe upon thy brow,
The rose bends over thee.
Only the morning sun hath leave
To turn thy waves to light,
Cool shade the willow branches weave
When noon becomes too bright.

The lilies are the only boats
Upon thy diamond plain,
The swan alone in silence floats
Around thy charmed domain.
The moss-bank's fresh embroidery,
With fairy favors starred,
Seems made the summer haunt to be
Of melancholy bard.

Fair as thou art, thou wilt be food
For many a thought of pain;
For who can gaze upon thy flood,
Nor wish it to remain
The same pure and unsullied thing
Where heaven's face is as clear,
Mirrored in thy blue wandering
As heaven's face can be here?

Flowers fling their sweet bonds on thy breast,
The willows woo thy stay;
In vain, — thy waters may not rest,
Their course must be away.
In yon wide world, what wilt thou find?
What all find — toil and care:
Your flowers you have left behind,
For other weight to bear.

The heavy bridge confines your stream,
Through which the barges toil;
Smoke has shut out the sun's glad beam.
Thy waves have caught the soil.
On — on — though weariness it be,
By shoal and barrier crossed,
Till thou hast reached the mighty sea,
And there art wholly lost.

Bend thou, young poet, o'er the stream —
Such fate will be thine own;
Thy lute's hope is a morning dream,
And when have dreams not flown?
— *Miss Landon*

XVIII. PONDS, LAKES AND MARSHES

"We will not go back by the same way that we came, for I think we may come across a thing or two different from what we have seen thus far.

"Here we find a brook which does not reach creek or river."

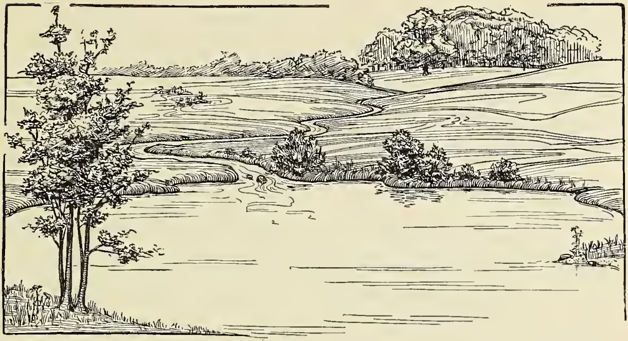
"This is the brook that runs into our pond," said Henry.

"Why does not the pond empty into the creek?" asked the teacher.

"Because the land around it is too high," replied several.

"I would like you to imagine a pond very, very much larger than this one, with the land around it raised so high that the water is held in. Such bodies of water are called lakes.

"Sometimes their waters flow out by a stream or river, and sometimes the only way for the water to get out is by evaporation. There are lakes that are many miles in length and breadth, and the reason that they are kept full of water is that the water flows into them from streams and springs faster than it can get out by streams or evaporation.



"But sometimes the water that gathers in a hollow is not drained by a stream, and the land around is not very high, rocky or sandy; then the water is so shallow that it mixes with the soil, and softens it until the whole place is very muddy."

"Oh! that's a marsh!" cried Mary. "There's a marsh back of our pasture. My brother went down there the other day for the first time to drive the cows home, and he had great trouble in getting back, for he sank up to his knees in sticky mud at every step."

"Land like that is also called a swamp, or bog; and when it is needed for cultivation it is drained, that is, a ditch is dug, and the water flowing into it forms a stream. Land that has been drained in this way is often very rich. In some countries the most fertile spots have been made in this way."

XIX. PLAINS, VALLEYS, HILLS, MOUNTAINS

"We are now getting down to the level country; the stream flows lazily along, and the water in it is quite clear. We can, by looking at the direction in which the stream flows, tell the slope of the land. If the streams flow east, the general slope of the land is east; where the streams flow west, the general slope is west.

"Let us look at the leaf again, the stems and veins of which we compared to a river system. Which part of the system would be the lowest?"

"The river itself," was the answer.

"Yes, the main river, as represented by the stem. Then from the main river, the land on either side would rise, until the country would be quite high, where the smaller streams are. When you make a study of river systems on the map, I hope that you will be able to tell the general slope of a country from its rivers. The basin of a river, you will recall, is the land that is drained by the river. It is usually called a valley. Do you know what a valley is?"

"A valley is the hollow between hills," said William.

"The hills may not be very high, and the place may not be very hollow, but it may be a valley for all that," said the teacher, "and as I said before, we may find the slope by looking at the direction of the streams. If the valley is very broad and level, it may be called a plain."

"I thought that plains were always flat, and had no hills anywhere around," said John.

"And you are right," said the teacher. "Strictly speaking, a plain is such as you describe, but the word is often used to denote level land, whether it be great or small in size. The flatness of the surface is all you need have in mind when thinking of a plain.

"Some plains have hardly any trees, grass, or other plants, and are very sandy. Such plains are called deserts. The immense plains in our own country that are covered only with grass are called prairies.

"Various countries have special names for the plains they contain, and these names you will learn when you come to study these countries.

"A high plain is called a *plateau*.

"The land over which we have been traveling is quite hilly in some places. You will remember that as we went up the hill I was almost out of breath, and I asked you to walk more slowly. Now, try to think of hills very much higher than these."

"Such high hills would be mountains," said Mary. "We usually go to the mountains for a few weeks every summer. Father says that one

of the mountains which we climbed last summer is nearly three thousand feet high. How tired I was when we got to the top!"

"Well, that mountain was nearly thirty times as high as the church steeple in our village. But the mountain you climbed is not considered very high. Just think of a mountain five miles high! Of course, mountains like that do not rise out of the plain, and their height is calculated from the level of the sea. At the base or foot of a system of mountains, there is usually a succession of hills, called foothills, so that the mountains are reached gradually. We cannot get right under them, as we do when looking at the church steeple, and so they do not at first strike us in all their grandeur. But they grow on us as we look at them. I hope now that you have a clear idea of the forms of land known as plains, valleys, hills, and mountains."

THE HILLS

Behind my father's cottage lies
A gentle grassy height,
Up which I often ran — to gaze
Back with a wondering sight;
For on the chimneys I looked down —
So high — below me quite!

All round, where'er I turned mine eyes,
Huge hills closed up the view;
The town, 'midst their converging roots,
Was clasped by rivers two;
From one hill to another sprang
The sky's great vault of blue.

Oh, how I loved to climb their sides,
And in the heather lie!
From mighty vantage gazing down
On the castle grim and high;
Blue streams below, white clouds above —
Unmoving in the sky!

And now, wherever I may roam,
At sight of stranger hill,
A new sense of the old delight
Springs in my bosom still;
And longings for the high unknown
The ancient channels fill.

For I, always climbing hills,
  From the known to the unknown —
Surely, at last, on some high peak,
  Will find my Father's throne,
Though hitherto I've only found
  His footsteps in the stone.

And in my wanderings once I met
  Another, searching, too;
The dawning hope, the sharèd quest
  Our hearts together drew;
She laid her trusting hand in mine,
  Unquestioning and true.

She was not born among the hills,
  Yet on every mountain face
A something known her inward eye
  By inborn light can trace;
For up all hills must homeward be,
  Though no one knows the place.

Clasp my hand close in thine, my child —
  A long way we have come!
Clasp my hand closer yet, my child,
  We farther yet must roam —
Climbing and climbing, till we reach
  Our heavenly Father's home.

— *George Macdonald*

XX. DRAINAGE AND WATER SUPPLY

"How glad I am that we live in the country!" said Mary. "When we lived in the city, we had no way of finding out all these things."

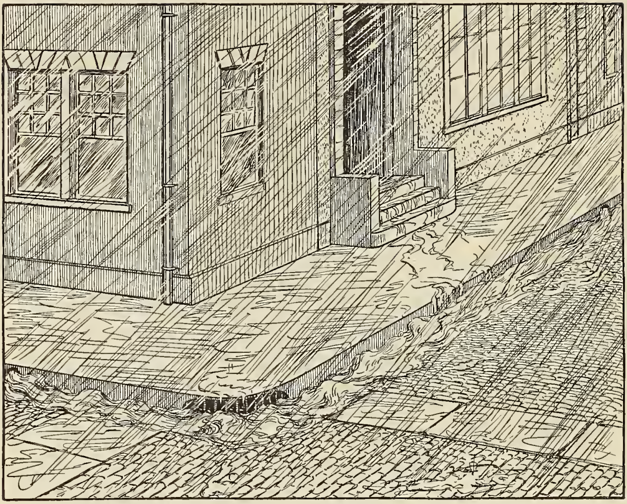
"Many of the facts we have been learning can be found in the city," said the teacher. "The rain falls in the city as well as here."

"So does the snow," said John.

"And the hail," added the teacher. "The water from these reaches the sea as surely as the water from our brook, even if they fall in the city. Mary, you surely must have watched the streams that were made by rain."

"Yes, the water ran into the gutter, and then into the sewer," said Mary.

"In the city there are big pipes that have been laid under the ground for the purpose of carrying off the drainage. These pipes do the work of the drains that you often see here in the country, and empty into the river or lake which is usually near the city. While the rain in the country lays the dust and refreshes the trees, the grass, and the other vegetation, the rain in the city lays the dust and washes the streets and houses. How clean



everything looks after a rainstorm in the city or country, after the sun has dried up the mud! For some time after the rain has stopped, you can see the streams rushing along in the gutters carrying in the muddy water whatever will go along.

"The rain benefits the city people in still another way. You know that city people depend on the country for their food, and the material for their food and shelter, but perhaps you did not know that they get their supply of water from the country as well."

"Have they no wells or springs of their own?" asked John.

"No large city will permit wells to be sunk, except Artesian wells, about which you will learn at some future time," replied the teacher. "The water that is used by the city people is brought to their houses in pipes that run under the streets from a large reservoir. This reservoir is fed by pipes from streams or lakes that may be many miles away. These streams and lakes depend on rain for their water. So you see how much the city people depend upon a full supply of rain."

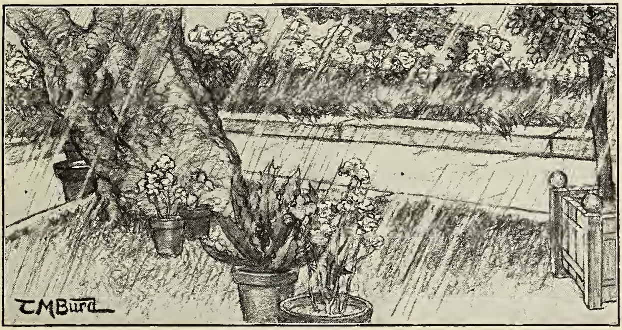
RAIN IN SUMMER

How beautiful is the rain!
After the dust and the heat,
In the broad and fiery street,
In the narrow lane,
How beautiful is the rain!

How it clatters along the roofs,
Like the tramp of hoofs!
How it gushes and struggles out
From the throat of the overflowing spout!
Across the window pane
It pours and pours;
And swift and wide,
With a muddy tide,
Like a river down the gutter roars
The rain, the welcome rain!

The sick man from his chamber looks
At the twisted brooks;
He can feel the cool
Breath of each little pool;
His fevered brain
Grows calm again,
And he breathes a blessing on the rain.

From the neighboring school
Come the boys,
With more than their wonted noise
And commotion;



And down the wet streets
Sail their mimic fleets,
Till the treacherous pool
Engulfs them in its whirling
And turbulent ocean.

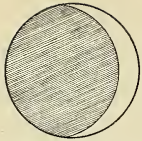
In the country on every side,
Where far and wide,
Like a leopard's tawny and spotted hide
Stretches the plain,
To the dry grass and the drier grain
How welcome is the rain!

In the furrowed land
The toilsome and patient oxen stand;
Lifting the yoke-encumbered head,
With their dilated nostrils spread
They silently inhale
The clover-scented gale,

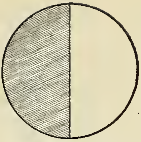
And the vapors that arise
From the well watered and smoking soil.
For this rest in the furrow after toil
Their large and lustrous eyes
Seem to thank the Lord,
More than man's spoken word.

Near at hand,
From under the sheltering trees,
The farmer sees
His pastures and his fields of grain,
As they bend their tops
To the numberless beating drops
Of the incessant rain.
He counts it as no sin
That he sees therein
Only his own thrift and gain.

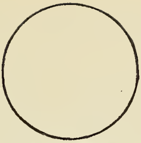
— *H. W. Longfellow*



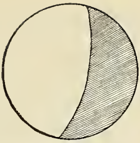
NEW MOON



FIRST QUARTER



FULL MOON



WANING MOON

XXI. THE MOON AND ITS PHASES

As the little party reached the outskirts of the city, they stopped as if by common consent to admire the beautiful sunset. The sky was all crimson, and seemed to have an unusual beauty.

"See how long the shadows are!" exclaimed the teacher. "Can you recall how short the shadow of our flag-pole was at noon?"

"That was when the sun was high in the sky," said John. "I have seen shadows as long as these early in the morning, when the sun was just peeping over the hills."

"See the new moon!" cried several voices.

"Why, it has been in the sky all day," said the teacher. "We could not see it because it was so near the sun."

"I have seen the moon during the day many a time," said Harry.

"I would like you to note closely the shape of the moon at this time. In which direction do the horns or ends of the moon point?"

"Toward the east," said Frank.

"Yes. To-morrow the moon will rise somewhat later. I do not say to-morrow evening, for it will rise early in the morning, and follow the sun all day, just as the new moon did to-day. The moon rises fifty minutes later each day."

"It grows a little larger each day, too," said William.

"It is said to *wax*, when it grows larger. When it is like a half circle, it is said to be in its *first quarter*," said the teacher.

"And when it grows to be a whole circle," said Henry, "it is said to be *full*."

"*Nearly* a whole circle," said Miss Smith, "for we never see quite the whole of the lighted part of the moon. Where does the moon get its light?"

"From the sun, I think," said Harry.

"Yes; the moon *reflects* the light of the sun. When full the moon is in that part of the sky directly opposite to where the sun is. A full moon rises about sunset, and sets at about sunrise, but the moon in its first quarter rises at about midday and sets about midnight. What is the next change that the shape of the moon appears to have after it has become full?"

"It sets," said a little fellow.

"I do not wonder that you say that," said the teacher, "for you can hardly be expected to know. After the moon has appeared to us for a couple of nights as a full moon, it begins to get smaller, or to *wane*, as it is called. Each night, as before, it rises fifty minutes later, and gets smaller until it reaches its *third quarter*, when it shows only a semicircle of light, as in the first quarter. People who go to bed early do not see a moon in the third quarter, because it does not rise until midnight. Then the moon gets smaller and smaller until it again becomes a crescent — only that the horns now point to the west, instead of the east, as in the new moon. It takes about a month for the moon to pass through these stages: *waxing*, from new to full, and *waning* from full back to the slender crescent. In fact, *month* comes from *moon*, and people instead of reckoning time by so many *months*, used to speak of so many *moons*. But it is time for us to hurry along.”

“I see the Dipper,” said Harry.

“Can you pick out the North Star?” asked the teacher.

“Yes; there are the pointers, and I can follow them along till I come to the North Star.”

“The North Star is in the Little Dipper,” said the teacher. “But here we are in the town. I wish you good night, and I hope that your parents have not been alarmed at your long absence.”

THE NEW MOON

Dear mother, how pretty
The moon looks to-night!
She never was so cunning before;
Her two little horns
Are so sharp and so bright,
I hope she'll not grow any more.

If I were up there,
With you and my friends,
We'd rock in it nicely, you'd see;
We'd sit in the middle
And hold by both ends;
Oh, what a bright cradle 'twould be!

We would call to the stars
To keep out of the way,
Lest we should rock over their toes;
And there we would rock
Till the dawn of the day,
And see where the pretty moon goes.

And there we would stay
In the beautiful skies,
And through the bright clouds we would roam;
We would see the sun set,
And see the sun rise,
And on the next rainbow come home.

— *Mrs. Follen*

XXII. THE DAY AND THE YEAR

"Our little journey yesterday was, I am sure, of great profit to us. Perhaps our talk on the moon and its *phases*, as we call the different shapes of the moon as they appear to us, may leave a stronger impression on you than the other things we talked about, so I shall take the moon as the starting-point of our lesson to-day.

"The moon is round like a ball, and the reason that it shows only a part of a circle to us, is because we are able to see only a part of the side that is lit up by the sun. Has any one ever heard of the 'old moon in the new moon's arms'?"

Not many hands were raised, and these with some hesitation, so the teacher continued:

"Well, the earth reflects the light of the sun just as the moon does. In fact, if we were on the moon, the earth would be our moon, only several times larger than the earth's moon. Now, sometimes the light that the earth reflects to the moon is dimly seen at the time of our new moon, and the faint outline of the moon which the light from the earth reveals has given rise to the expression the 'old moon in the new moon's arms.'

"Not only is the moon round like a ball, but so are the earth, the sun, and the stars that seem so small. The stars appear small because they are so far away. The moon seems small, even when it is full, although it is over two thousand miles across. The sun, though very many times larger than the moon, does not appear large to us, because it is millions of miles away from us.

"I have said that the earth is round like a ball. I know you find it hard to believe this, but there are several proofs that you will learn before long. The earth seems flat because we see so little of it at a time. The fly that creeps on an orange or a ball finds it somewhat flat, just as the earth seems flat to us.

"But the earth is a great ball, and it goes rolling on in the heavens, just like the moon and the stars, and travels faster than the fastest train. It also turns completely around once in twenty-four hours."

"But I thought that the sun went round the earth once a day," said Walter.

"No; that is where many people have made a mistake," said the teacher. "When you are traveling in a train, you seem to be perfectly still, and the trees, houses, and telegraph poles appear to be moving back from you. So, instead of the sun traveling around us from east to west, we are turning from west to east, making a complete turn in a day. You see, now, how another division of time is made. The day marks one complete turn, or rotation, that the earth makes.

"Still another division of time is the year. The earth makes a journey around the sun in a year. Into how many seasons is the year divided for us?"

"Four," the class replied in chorus.

"Yes, and sometimes we are nearer the sun than at others."

"We must be quite near the sun in summer," said William.

"No; we are farthest from the sun in summer," said the teacher.

"Then, why is it so hot in summer?"

"What have you noticed lately about the shadow of our flag-pole at noon?"

"It is getting longer," said John; "in winter the shadows at noon are always longer than during the other seasons."

"Why is that?"

"Because the sun is not so high in the sky," said Henry.

"In summer, the shadow at noonday is quite short, because the sun is at its highest point in the sky for us, even though it be further away from the earth than in winter."

"Then why are not all the days hot in summer?" asked Mary.

"Who can answer Mary's question? You may try, Ellen."

"There are other things that prevent the sun's force from heating us too much. The rain may cool the air, and the wind may be blowing," said Ellen.

"That is true in a sense," said the teacher. "You will learn other reasons if you ever make a fuller study of climate and temperature. We will try to have something more on this subject to-morrow."

THE SEASONS

Sing a song of spring-time,
The world is going round.
Blown by the south wind:
Listen to its sound.

Like a song of Summer,
The world is nearly still,
The mill-pool has gone to sleep,
And so has the mill.

Sing a song of Autumn,
The world is going back;
They glean in the corn-field,
And stamp on the stack.

Sing a song of Winter,
The world stops dead;
Under snowy coverlid
Flowers lie abed.

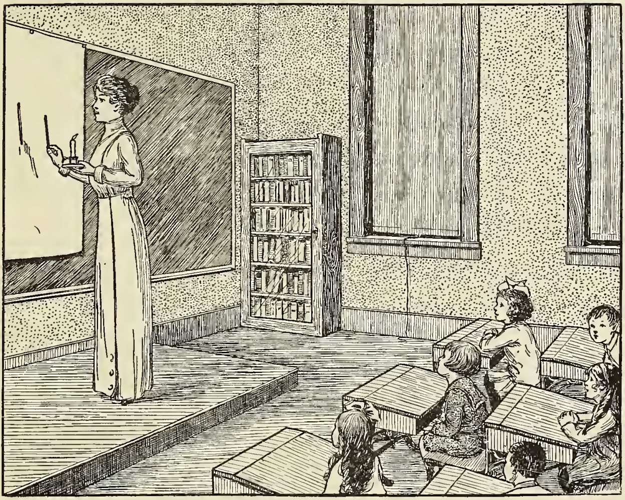
— *Cosmo Monkhouse*

XXIII. THE EARTH MOVES FROM WEST TO EAST

"You have been observing the shadow which our flag-pole casts, but there are a few facts about shadows which I think you will understand better if I illustrate them right here in the class-room. I will light this candle, and those pupils nearest the windows may close the shutters. The candle does not give us very much light, but it will cast shadows clear enough for our purpose.

"As I hold up the pencil, you note the shadow that is cast. I hold the pencil steadily and move the candle up and down. As I do so, the shadow gets smaller, and is smallest when the light is directly over or under the pencil. Of course, the shadow of the candle itself interferes with us somewhat, but we shall not mind that. Now, watch the shadow move. If I move the candle to the right the shadow moves to the left.

"I now set the candle on the table, and move the pencil. The shadow of the pencil moves with it. By moving the candle to the right, the shadow of the pencil moves to the left. But by moving the pencil to the right its shadow moves to the right also.



"Shadows cast by the sun on the earth are always moving from west to east. If the earth moves around the sun, the shadows cast by the sun ought to tell us the direction in which the earth is moving, just as the pencil's shadow tells in which direction the pencil is moving. Let us consider this a moment.

"The east side of a house — that is, the side facing the east — is lighted up by the morning sun, and the west side is shaded. As the sun gets to the south, as we say, the north side of the house is shaded. In the afternoon the east side of the house is shaded. So we see that the shadow travels from the west around by the north to the east, or from west to east. If we look at the shadow of our flag-pole, we can observe this. I can illustrate it by the pencil and the candle, moving the candle around just as the sun appears to move.

"You may now open the shutters," said Miss Smith, as she blew out the candle.

XXIV. THE SEASONS

"One of you said, a few days ago, that the sun was not so high in the sky at noon in winter as in summer, and that, therefore, shadows are longer in winter than in summer. Who can tell me when, in winter, the shadow at noon is longest?"

No one could answer.

"Well, we are nearing noontime now, and I want you to watch the shadows carefully. For a few days you will not be able to note much change in their length, for the sun appears to have the same place in the sky that it had the day before. That time is called the winter *solstice,* and it occurs about December 21."

"That is the shortest day in the year," said James.

"Yes, it is for us," said the teacher. "Although we usually consider that winter begins with the month of December, some people prefer to consider December 21 as the beginning of winter. Now, in a couple of days after December 21, the shadows at noon begin to grow shorter, and about June 21 they are the shortest in the year."

"That is the longest day in the year," said James.

"Yes," returned the teacher, "about this time the sun shines on us for a few minutes more than fifteen hours, while about December 21 we have the sun for about nine hours and a quarter. I have here an almanac which tells me these things. I shall mark it and pass it around.

"Between December 21 and June 21, there must be a time when the days and the nights are of equal length — that is, twelve hours each."

"That's the equinoctial time," said James.

"I see, James, that you already know something about our lesson," said the teacher.

"Oh, Father makes me look at the almanac once in a while," said James.

"That is very good for you, James; but do you know the meaning of equinoctial?"

"Equal nights," said James.

"That will do well enough for a definition now. But when do we have equal days and nights?"

"On March 21, and September 21," said James.

"Well, to speak exactly, in our part of the earth the equinox is a little earlier in March and a little later in September. But, generally speaking, about March 21, and September 21, the days and nights are equal all over the world. Now, these four points are often used to denote the beginning of the four seasons. Accordingly, spring may be said to begin on March 21, summer on June 21, autumn on September 21, and winter on December 21."

XXV. VARIOUS KINDS OF FOOD

"I now intend," said the teacher, "to turn your attention to the things that we need for food. You may write down the names of as many kinds of food as you can remember, and I shall pass around the class and take a rapid glance at what you write. Bread, meat, eggs, fish, butter, apples, cheese, potatoes, pies. You think of these readily enough. Let us stop a moment. Where does bread come from?"

"From the baker's!" called out a little fellow.

"My mother makes her own bread," said a little girl with an air of importance.

"Tell us how she makes it," said the teacher.

"She takes her flour, mixes it with water and a little yeast, puts in a handful of salt, and lets the batch stand over night; then she kneads it well and bakes it in the oven."

"That is very well told," said the teacher. "Now who will tell us where the meat comes from?"

"From the butcher's," said several.

"Yes, but where does the butcher get the meat?"

"From the cows, sheep, pigs, and chickens that he kills," was Harry's answer.

"Then there must be several kinds of meat," said the teacher. "But it will be enough for us to call all these kinds flesh meat. Animals such as have been mentioned are not the only ones that furnish us with food, for there are the fishes, and some reptiles, like the turtle. Then some animals furnish us with eggs and milk. All this is called animal food.

"In addition to animal food, we have vegetable food, or food that grows out of the ground, either in such a form that we can use it in a raw state, or so that it must be cooked to be fit to eat. I would like you to mention some fruits and vegetables that may be eaten raw."

"Apples", "peaches", "plums", "grapes", "tomatoes", "radishes", came in quick succession.

"Now think of some vegetables that need very little preparation for cooking."

"Potatoes", "tomatoes", "corn", "cabbage", "beets," followed rapidly.

"I knew that you could recall a great many of these vegetables," said the teacher. "I have only started the lesson, and I want you to continue it. I would like you to write in one column the names of all the different kinds of flesh meat that you can think of; then you may write the names of some animal products, not flesh, that are used for food. In a third list, you may write the names of all the different kinds of fish you can think of, including shellfish, and then write down the names of a number of articles of vegetable food. In writing these, mention first those that can be eaten in the raw state, and then those that require cooking."

THE SOWER'S SONG

Now hands to seedsheet, boys,
We step and we cast; old Time's on wing
And would ye partake of Harvest's joys,
The corn must be sown in spring.
Fall gently and still, good corn,
Lie warm in thy earthly bed;
And stand so yellow some morn,
For beast and man must be fed.

Old Earth is a pleasure to see
In sunshiny cloak of red and green;
The furrow lies fresh; this year will be
As years that are past have been.
Fall gently and still, good corn,
Lie warm in thy earthly bed;
And stand so yellow some morn,
For beast and man must be fed.

Old Mother, receive this corn,
The son of six thousand golden sires:
All these on thy kindly breast were born;
One more thy poor child requires.
Fall gently and still, good corn,
Lie warm in thy earthly bed;
And stand so yellow some morn,
For beast and man must be fed.

How steady and sure again,
And measure of stroke and step we keep;
Thus up and thus down we cast our grain;
Sow well, and you gladly reap.
Fall gently and still, good corn,
Lie warm in thy earthly bed;
And stand so yellow some morn,
For beast and man must be fed.

— *Thomas Carlyle*

XXVI. THE USEFUL GRAINS

"I have brought with me some dried grasses which you will know as soon as you see them. You will notice at the ends little clusters of seeds, or grains. Here is a stalk of the most useful grain. What is its name?"

"Wheat!" the answer came as from one voice.

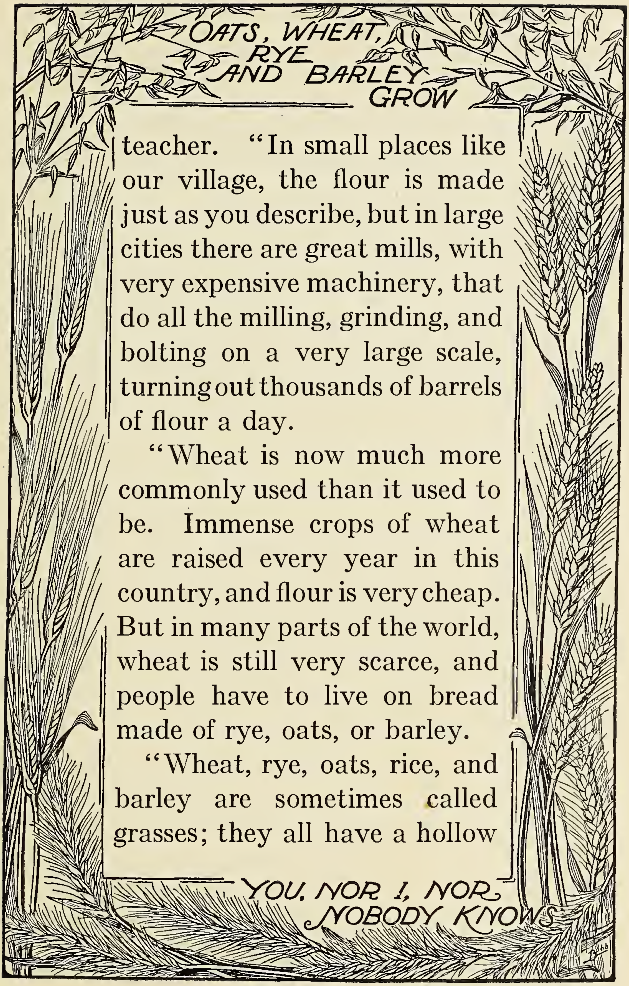
"You have seen fields of wheat waving in the wind. Of what use is this grain? You may tell, Alice."

"It is made into flour."

"Can you tell how it is made into flour?"

"After the wheat has been cut, it is tied up into bundles, brought to the barn and threshed with long flails, or with a threshing machine. This separates the grains from the stalk. Then the grains are brought to the mill and ground between two large millstones, or crushed between rollers. After the grains of sand and dirt and the little pieces of the husk about the kernel of wheat have been cleared out by sifting or bolting, there passes through the sieve the beautiful white flour of which our bread is made."

"You have explained that very nicely," said the


OATS, WHEAT, RYE AND BARLEY GROW
YOU, NOR I, NOR NOBODY KNOWS

teacher. "In small places like our village, the flour is made just as you describe, but in large cities there are great mills, with very expensive machinery, that do all the milling, grinding, and bolting on a very large scale, turning out thousands of barrels of flour a day.

"Wheat is now much more commonly used than it used to be. Immense crops of wheat are raised every year in this country, and flour is very cheap. But in many parts of the world, wheat is still very scarce, and people have to live on bread made of rye, oats, or barley.

"Wheat, rye, oats, rice, and barley are sometimes called grasses; they all have a hollow stalk. The stalks of the grasses, when dried, are called straw.

"In some countries, rice is the principal article of food all the year round. It requires a warm climate and moist ground, while wheat requires fairly dry ground, and will grow where the climate is cooler. In countries where the weather is too cold for wheat to thrive, rye, oats, and barley will grow well. Wheat is said to be *hardier* than rice and corn, while oats, rye, and barley are still hardier than wheat."

XXVII. TEA

"The grasses which furnish the useful grains you have all seen growing, but many a child in the city has seen only the flour or the grain. Now, there are many articles of vegetable food that you and I have never seen growing, but which we use every day. These are brought to us from places that are far away. Write down the names of some of the articles of food that are vegetables and which you have never seen growing."

The teacher passed around, and while the pupils were writing she called out the names she saw: "Tea, coffee, pepper, raisins, prunes, oranges, bananas, — well, you have written enough for the present. Some of these are fruits, — dried fruits, — while some are fruits that remain fresh for quite a while. Let us take a little time to consider tea. Where does it come from?"

"From China!"

"And Japan, Ceylon, and India," added the teacher. "Now, what is tea?"

"It is a leaf," said Henry.

"Yes, it is the leaf of a shrub that, when cultivated, is not permitted to grow higher than six or

eight feet. These shrubs are planted in rows three or four feet apart, on the sunny side of hills. A field planted with these shrubs looks very much like a garden of gooseberry bushes. The leaves are picked three times a year. The first crop gives a fine, tender leaf, which when dried makes the most delicious as well as the most expensive tea. The leaves of the second crop are never bitter, while the third crop produces leaves that are tough and yield tea of the poorest quality."

"Did you say that the tea leaves were dried?" asked Susan.

"Yes," replied the teacher. "They are first spread out on trays of bamboo for an hour or two to dry. They are then placed on drying pans and rapidly moved about. As the heat affects them, they make a crackling noise and become quite moist. After being in the pan four or five minutes, they are thrown upon a table and rolled with the hands. They are again dried, and again rolled. When this has been done and the desired color of the rolled leaves obtained, they are passed through sieves of various sizes, to get rid of the dust, and to sort the different kinds."

"You said something, Miss Smith, about the color; what is the color desired?" said James. "Do you mean the black and the green tea?"

"Just then," said the teacher, "I was thinking of only one kind of tea, green tea, and I meant that the workmen were careful to treat the leaves so as to get the proper shade of green. Black tea is made from the leaves of the same plant as green tea. The difference is in drying and in the length of exposure to the air. Black tea is exposed to the air for a much longer time than green tea, and is often dried in the sun as many as four times. It is then dried slowly over charcoal fires."

THE COFFEE SLIPS

Whene'er I fragrant coffee drink,
I on the generous Frenchman think,
Whose noble perseverance bore
The tree to Martinico's shore.
While yet her colony was new,
Her island products but a few,
Two shoots from off a coffee-tree
He carried with him o'er the sea.
Each little tender coffee slip
He waters daily in the ship,
And as he tends his embryo trees
Feels he is raising midst the seas
Coffee groves, whose ample shade
Shall screen the dark Creolian maid.

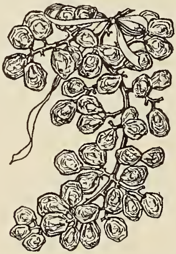
But soon, alas! his darling pleasure
In watching this his precious treasure
Is like to fade, — for water fails
On board the ship in which he sails.
Now all the reservoirs are shut,
The crew on short allowance put;
So small a drop is each man's share,
Few leavings you may think there are
To water these poor coffee plants; —
But he supplies their gasping wants,
Even from his own dry parched lips
He spares it for his coffee slips.

Water he gives his nurslings first,
Ere he allays his own deep thirst,
Lest, if he first the water sip,
He bear too far his eager lip.
He sees them droop for want of more; —
Yet when they reached the destined shore,
With pride the heroic gardener sees
A living sap still in his trees.
The islanders his praise resound;
Coffee plantations rise around;
And Martinico loads her ships
With produce from those dear-saved slips.

— *Lamb*

XXVIII. OTHER FOOD PRODUCTS

"Coffee beans are the seeds of a shrub which grows best in the dry soil of warm countries. The berries are gathered and crushed to remove the seeds, which are then dried in the sun. Each berry has two seeds, or beans as they are called, laid with their flat sides close to each other. After being cleansed of the husks, the seeds are shipped in bags.



"Sugar is obtained in various ways. Much comes from the sugar-cane and from beets, while smaller quantities are obtained from the sugar-maple and from several other plants. The sugar that we use has been refined.

"Pepper is the fruit of a shrub that clambers somewhat like a vine. This shrub grows wild in some places, but it is cultivated in others. The berries of the shrub, when ripe, are about the size of a pea, and are of a bright red color.

"They grow in bunches containing twenty or thirty berries in a cluster. When they are plucked, they are dried by being spread upon mats. Black pepper and white pepper are but different preparations of the same berry. When the berry is ground with the husks on, black pepper is obtained, and when the husk is carefully peeled off before grinding, white pepper is the result. Cayenne pepper is from a pod that is in no way like the regular pepper plant.

"Raisins are grapes dried in the sun. The best raisins are made when the stems of bunches of ripened grapes are partly cut, and the fruit is allowed to dry upon the vines.

"Prunes are the dried fruit of the plum tree. The finest prunes come from France.

"Oranges and bananas also come from places where the climate is very warm. Bananas form the prin-

cipal food of the people in some places. The fruit can be eaten raw, fried, or baked.

"I hope that you have seen, from the short lessons we have had on some of the foods which we do not find growing around us, how dependent we are on other people and other countries for some of the luxuries we enjoy. When you enter a grocery store you can see so much that has been gathered and prepared for our use by people far away, that you may be led to think of what we are doing for the people of other countries. Then when we come to talk of trade and business, you may be ready to answer my questions."

XXIX. OUR CLOTHING

"We have learned that we have to depend on animals and plants for the food we eat. We owe to them also the materials out of which our clothing is made. Let us see to what extent we can realize this. What is your apron made of, Sarah?"

"Of cambric," answered Sarah.

"Cambric is a kind of fine cotton cloth, which was originally made of linen, at Cambrai, France," said the teacher. "Now, what does linen come from?"

"From flax," was the reply.

"Of what is the ribbon in your hair made, Alice?"

"Of silk."

"Your necktie, William?"

"It is satin," replied William.

"Satin is a special preparation of silk," added the teacher, "and silk is made from the fine fibers spun by the silkworm. Of what material is your coat, Henry?"

"The dealer said it was all wool, but mother says she's sure there's some cotton in it," answered Henry.

"If she is right," said the teacher, "the material in your coat is a mixture of animal and vegetable product. You know where the wool comes from, I suppose?"

"I know that wool is the fleece of sheep, but I do not understand how it can be made into cloth," said Henry.

"You will understand that before very long," returned the teacher, "and you will also understand how cloth can be made from cotton like that which you see on this little twig," and she held up a fine specimen of a cotton boll.

"Your shoes are made of leather, James. Where does the leather come from?"

"The tanner's," replied James. "The hides of the cattle are brought to the tannery, and made into leather."

"My gloves are made of kid, which in trade means not only the leather made from the hide of the kid, but any kind of soft leather. Then, too, animals furnish the furs that ladies wear, from the sealskin to the skin of the mink, otter, beaver, and many other animals. Fur is also used to make the felt out of which many hats are manufactured. But, without going any further, I think we have started subjects to keep us busy for several lessons. We shall consider one by one the various materials used in our clothing."

XXX. LINEN

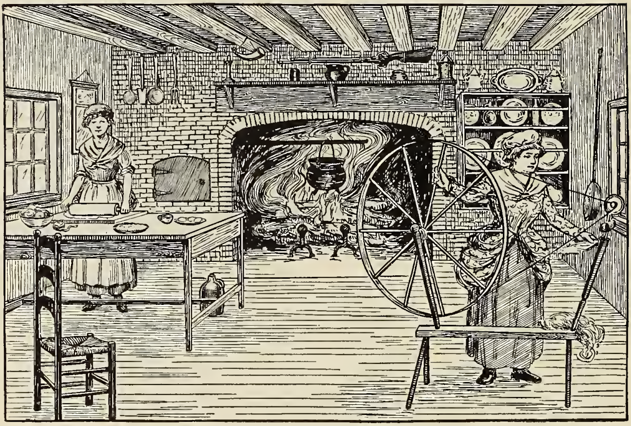
Apart from the plants that yield food, there is none that is more useful than the flax plant.

The oil pressed out of the seeds of this plant, called linseed oil, is greatly used in mixing paints and in the manufacture of printing ink. What remains after the oil has been pressed out may be made into *oil cake*, and used to fatten cattle, or it may be ground into *linseed meal* and used to make poultices.

Linseed tea is a valuable medicine, often used to allay the soreness in the throat caused by a cold.

But useful as the seed is, the fiber of the plant is still more useful. It can be used to make the finest lace as well as the coarsest and strongest sail-cloth.

The flax plant is rarely more than three feet high, and when ripe it bears flowers of a beautiful blue. While the flowers are blooming is the time when the fiber is best fitted for being turned into use.



The plants are then pulled up by the roots, and after being sorted according to size, are passed through a kind of comb, to remove the seeds. The plants are then left to steep in water for a time. A kind of rotting sets in, which makes it easy to separate the fibers from the woody portion of the stem.

There are four processes through which the flax must go before the fibers are separated and ready to be spun into threads.

Formerly a spinning-wheel was an important household article. No house was considered furnished without it. Every family prepared its own flax, and the mother of the family and her daughters employed a great deal of time in spinning. In many places this practice is still kept up. But the preparation of the flax takes so much time, and machinery has been invented to do so rapidly the work that used to be done slowly and painfully by hand, that it does not pay for families to do their own spinning, to-day. Nevertheless, the finest linen is still spun by hand.

After the flax fibers have been spun into thread, the thread is woven into cloth by the weaver, or made into lace.

XXXI. COTTON

The cotton plant is very delicate and requires a warm climate. It is found profitable to prepare the soil anew every year before planting the seed, which is sown in rows three or four feet apart.

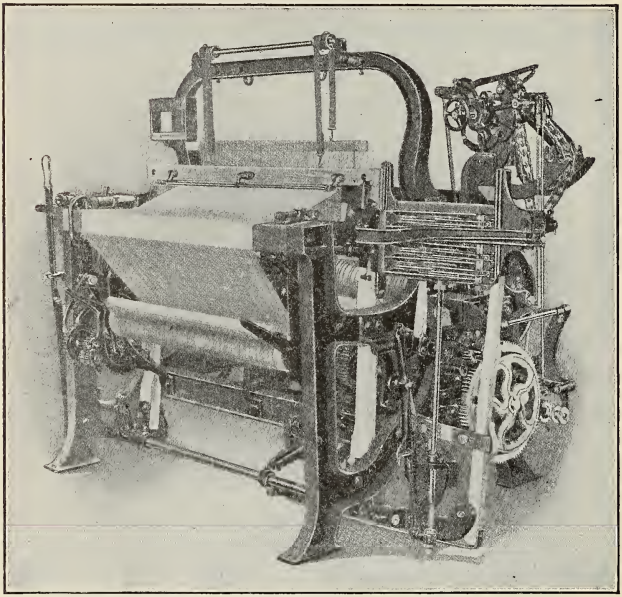
The sowing usually begins in March, but it is often delayed as late as May if the frost has not entirely left the ground. In about ten days after sowing, the shoot makes its appearance, and it grows rapidly until the beautiful yellow flowers appear early in June or in the latter part of May.

Up to this time, an occasional shower does no harm to the plant, but after the flowers appear, warm and dry weather is necessary to produce a good crop.

Picking begins in August and continues until the frosts of the fall stop the growth of the plant. The negroes have been found the most serviceable workers in the cotton-field, because they are better able than other races to withstand the direct rays of the sun. They pick the bursting cotton bolls from the shrub and put them into baskets or bags.

After the cotton has been spread out in the sun and thoroughly dried, the little seeds are separated by the cotton-gin, and the raw cotton, as it is called, is then packed tightly into bales.

We send a great quantity of raw cotton to other countries. After the bales have been unpacked, the cotton is *carded*, or drawn out so that the fibers all lie in one direction. Then the fibers are spun or twisted into thread, and the threads woven into cloth.



Cotton is not so strong as linen, and it cannot be spun into such fine threads, but it is cheaper and in many ways more useful.

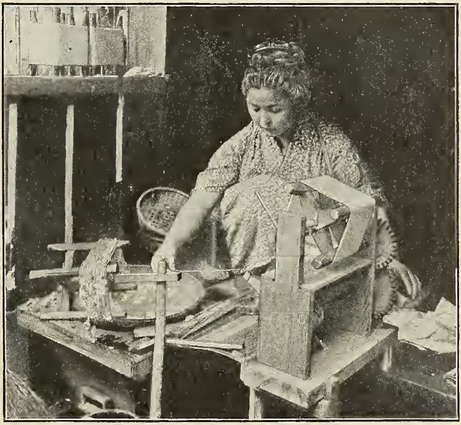
When the cotton seeds are pressed, an oil very much resembling olive oil is obtained.

XXXII. SILK

Silk is the thread spun by the silkworm. This worm is the caterpillar of a moth that first came from China. The body of the moth is about an inch in length, and to it are attached white wings streaked with black.

The caterpillar feeds very greedily on the leaves of the mulberry tree, and grows so rapidly that by the time it is five or six weeks old it has reached a length of about three inches. Then it stops eating, and begins to spin its *cocoon*, winding the slender thread about itself until it is completely hidden. In about a month it would work its way out of the cocoon and fly away, if it were allowed to do so.

The cocoons are not so valuable after the insect has worked its way out, however, and so, where attention is given to the manufacture of silk, the cocoons are thrown into hot ovens to kill the *pupa*—which the caterpillar has now become—before it has had time to eat its way out and come forth as the moth. The gum that fastened the threads of silk together is softened by the hot water into which the cocoons have been thrown; the covering of floss being then easily removed, and the fine silk unwound without much trouble.



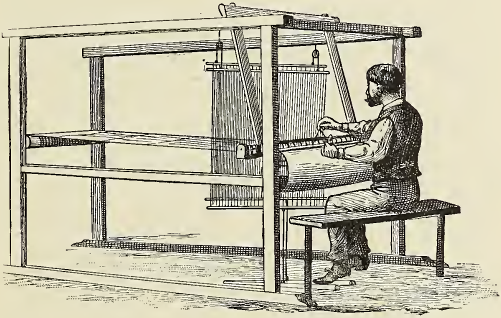
Three or four threads from as many cocoons are twisted together, and after being carefully washed the strands are made ready for the weaver.

In former times, we had to rely entirely on other countries for our supply of silk, but of late years the silkworm has been successfully reared in this country, and a small amount of silk has been obtained from our own cocoons.

Silk of an inferior quality may be obtained from the cocoons of the ordinary caterpillars which cling to our trees so plentifully in the late autumn.

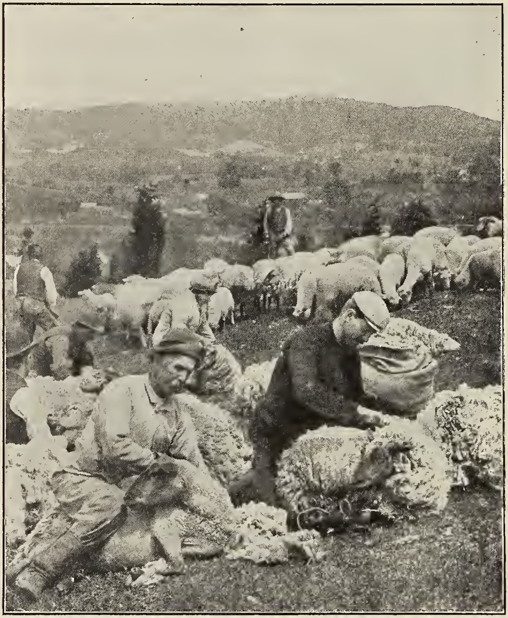
XXXIII. WOOL

It is not so long since a man might be seen dressed in a suit of clothes entirely home-made. The wool was sheared from his own sheep, combed and washed by himself, or by his man, spun by his wife into yarn, made into cloth by the village weaver, and cut and sewed into garments by the good wife. Those garments were not so elegant as the clothes many a man wears now, but they were very durable.



Machinery, however, is now used so largely, that the farmer who raises the wool sends it raw into the market, where the great manufacturers buy it, and make it into cloth in large quantities with very little trouble, expense, or delay, as compared with the processes of former times.

The manufacture of the wool into yarn or cloth is much like the process by which raw cotton is spun and woven.



Wool, however, has one property, apart from its warmth, that linen, cotton, and silk have not. That is, it can shrink.

If you pull a fiber of wool through your fingers one way, it will feel smooth like a hair; but if you pull the fiber in the opposite direction — against the grain, as people sometimes say — you will notice that the fiber is somewhat rough. As seen through a strong microscope, the surface of the fiber seems to have a number of scales overlapping one another. When wool is dampened and pressed together, the scales of one fiber catch into those of another, and hold fast. The more the fibers are pressed together, the more the goods of which they are composed will shrink. This catching together is further helped by the curliness or kinkiness of the fiber.

While we do not like to have our woolens shrink, this tendency, which is called *felting*, has enabled men to make a very thick cloth called felt, which is useful for many purposes.

We most commonly get our wool from the sheep, but the fleece of the Cashmere and Angora goats, as well as the wool or hair of the camel and other animals, is very valuable.

XXXIV. FURS

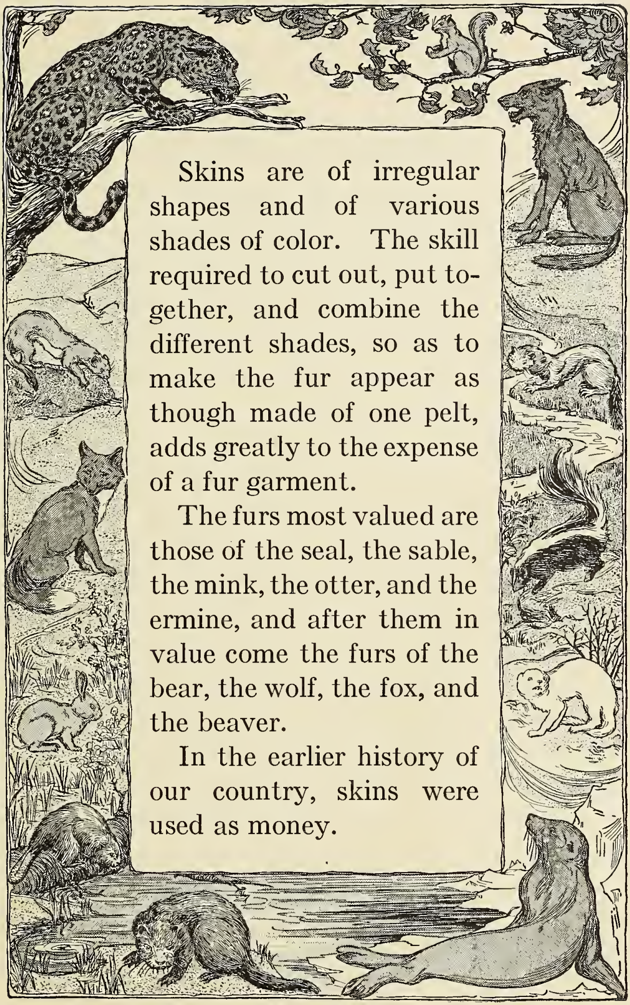
While the shrinking of woven wool is called *felting*, we must bear in mind that *felt*, strictly speaking, is not made of woven threads, but of a mass of fibers matted together.

Other kinds of fiber, or hair, as well as the fleece of sheep, are used in making felt. The felt of which our best hats are made is composed of the fur of the beaver, the hare, and the rabbit.

Warm and useful as woolens and felts are, they are not so light nor so warm as the skins of animals dressed with the hair.

Skins were probably the first clothing that men wore to protect them against the weather, and to-day dressed skins, or furs, form luxurious articles of dress.

The fur used in clothing or for ornament consists of the skin of the animal as well as the covering of the skin. Before being dressed, furs are called *pelts*. To prepare pelts for use, they are thoroughly steeped in a bath of salt, bran, and alum. The latter substance tans the skin into a fine leather. After the bath, the pelt is thoroughly washed in soap and soda, then rinsed off and dried.



Skins are of irregular shapes and of various shades of color. The skill required to cut out, put together, and combine the different shades, so as to make the fur appear as though made of one pelt, adds greatly to the expense of a fur garment.

The furs most valued are those of the seal, the sable, the mink, the otter, and the ermine, and after them in value come the furs of the bear, the wolf, the fox, and the beaver.

In the earlier history of our country, skins were used as money.

XXXV. LEATHER

Leather is made not only from the skins that can be dressed into furs, but also from those that are less thickly covered with hair, or that have scales. The skin of the sturgeon or of the alligator can be made into leather that is both beautiful and useful. Only the poorer grades of the skins that have good fur are dressed into leather.

The process of treating skins so as to convert them into leather is called *tanning*, from the name of a substance, *tannin*, which is used to give the skins the quality they possess as leather.

Before the skins are tanned, the hair, and the little pieces of flesh and fat that are on the raw skin, must be removed. The inside of the skin is composed of fibers, and between the fibers is a substance called *gelatine*. The fibers themselves are largely gelatine. This is what kept the skin soft and pliable while the animal was alive.

The gelatine in the dead skin soon decays and gives off a very unpleasant odor. If the gelatine, however, be treated with tannin dissolved in water, the soft, pliable skin turns to leather. The tannin is obtained mainly from the bark of oak or hemlock trees, which is ground very fine before being mixed with water.

The treatment by which the leather is obtained requires several months, the skins being frequently changed from one vat to another.

When the skins have been well tanned, they are washed, dried, and, after being pressed or rolled out, are stored away for the market.

XXXVI. DYES

Very few of the substances that we get from either plants or animals are used without being stained or *dyed.*

Cotton is naturally white, but linen becomes white only after being bleached. Both linen and cotton are sometimes dyed.

It is important to dye goods so that the color will not *wash out*, as it is called. The materials which furnish dyes are obtained from vegetables and animals, as well as minerals, or substances obtained by *mining*, *boring*, or *digging*. Of the vegetables, sometimes the root furnishes the dye, sometimes the stalk or bark, and sometimes the seed or leaf.

Indigo, madder, logwood, sandalwood, and sumach are among the vegetable dyes; cochineal and lac are animal products; and various preparations used for dyeing are made from lead, iron, and other metals as well as from some minerals not metal.

Beautiful dyes, called *aniline dyes*, are obtained from coal tar, and these are now used very freely in manufactures.

XXXVII. MINERALS

Many substances are obtained by going below the surface of the earth. Some of these grow in the soil and never appear above the surface until they are dug up. Such are *truffles*, which are used for food. In England, dogs are trained to hunt for these by scent, and in France pigs are employed for the same purpose. But truffles are *vegetables*.

There are, however, substances which are embedded or confined in masses of rock, and which are released by blasting, digging, or boring. These substances are not only the stones used in building, but the stones used in jewelry, metals, coal, petroleum or rock oil, and salt.

What a vast quantity of wealth is locked up in the rocks of the earth! Though the metals, like gold and silver, and the stones, such as the diamond, the ruby and the emerald, are usually looked upon as the most precious, there are metals and stones that are far more useful. Think of the iron, the lead, the copper, the tin, and the zinc that we see used so plentifully around us! Then consider the marble, the sandstone, and the granite, of which so many beautiful and massive buildings are made!

How much has our comfort been increased by coal, and how much has it helped to work the various metals!

The gas which lights our homes was once locked up in the coal, which the poor miner so laboriously digs out in his dark mine.

The oil which fills our lamps comes from a depth in the earth still lower than the coal.

The salt which is so necessary with our food, is found in springs of intensely salt water, or in solid beds deep in the earth.

So we see that the earth is a bountiful provider, giving us for our food and comfort not only from the vegetable and animal world, but from her very crust, itself.

XXXVIII. SHELTER

We need for our comfort something besides food and clothing. We must have protection from the heat and the cold, from the wind and the rain, as well as from frost and snow. Protection is needed from animals that roam around and, also, from human intruders who would molest us. This protection and shelter, the house affords.

When men do not intend to remain long in one place, they do not build solid houses, but only rude huts, or mere tents which may be easily carried from place to place.

Then, too, in not every place are solid materials for building at hand, and the poor savage has to content himself with the rudest sort of shelter.

We who live in comfortable homes can have but a faint idea of the discomforts in which some people live all the year round. Their whole life is a struggle to gain food and clothing, and to provide in the simplest way against the inclemency of the weather. Knowing no better, however, they do not seem to be unhappy.

During the coldest season — that is, during their night, which lasts for months — the Eskimos

live in huts neatly made of blocks of snow. In spite of the cold substance of which they are built, these houses seem comfortable enough to the poor savage, even though the only fire is an oil lamp. If his hut were heated, the Eskimo would soon find it disappearing about him in pools of water.

When newly finished, these huts are said to have a beautiful appearance. But however beautiful they may appear on the outside, they soon become filthy within. The place has no door or window save a narrow opening through which the inmates may crawl, — which serves the purpose of both. Therefore the lack of ventilation, and the herbs, fish, meat, and oil stored within, which soon become putrid, make the place anything but cleanly.

Some savage tribes in other countries live in caves, or shelter themselves under an overhanging rock.

One kind of dwelling that is in favor with savages is all roof. This roof is round, rising to a point in the center about seven feet high, and has an opening that serves as a chimney. It is built entirely of thatched straw.

Another kind of dwelling is in the shape of a beehive. The walls are a wooden frame-work coated with mud. Over this a covering of thatch is placed. Sometimes dwellings of this kind have a double roof, and greater protection as well as better circulation of air is obtained in this way.

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A singular kind of dwelling is that which is built on long poles, or even in the tops of trees.

You have probably seen pictures of the Indian's wigwam, which is nothing more than three or four poles or branches fastened together and covered with skins.

The more people become civilized, the more they enjoy a permanent home. Their knowledge of the materials both in and on the earth is brought into use, and not only wood, but stone and iron as well, are brought into service.

Not satisfied with having a roof to cover them, civilized people are accustomed to tables, chairs, sofas and, also, comfortable beds to sleep in. Uncivilized people have not learned to use any of these things. If you should go into any one of the huts that have been spoken of, you would find that the floor has to serve for table, chair, and bed.

XXXIX. OCCUPATIONS

"You now have some idea of the various products that are used to feed and clothe us, and of the means that some people take to shelter themselves," said the teacher. "Some of these products are at hand so that the producer himself may use them, but the farmer who contents himself with raising a few products is able to take better care of these, and to secure better crops, than the one who tries to raise on his own farm everything that he requires. Some kinds of soil and of climate are best fitted to raise wheat, others can best produce rye, or oats, or rice, or barley, and when the land grows poor, the farmer knows how to make it fertile again.

"Some kinds of land are best fitted for grazing, and cattle are raised for dairy products or for their flesh and hides.

"The raising of sheep requires careful attention, and those persons who devote themselves to rearing immense flocks for their wool, hides, and flesh are able to secure better results for their labor than those who divide their attention.

"How do those that raise the different products manage to dispose of them? You may answer, Robert."

"They take them to market," was the reply, "and those that want them are on hand to buy."

"That is the way in which some of the products are disposed of, and formerly all were sold in this way," said the teacher, "but nowadays agents or buyers do not wait until the crop has been gathered, but go to the producer and engage him in advance to sell what he raises. So you see that we have not only the farmer, the cattle-grazer, and the persons who follow the various trades of weaving, tanning, woodcutting, machine-making, and so on, but the agent who arranges the sale of the goods. Who can mention some other occupation?"

"Carpenter", "mason", "bricklayer", "plasterer", "tailor", "shoemaker", were mentioned.

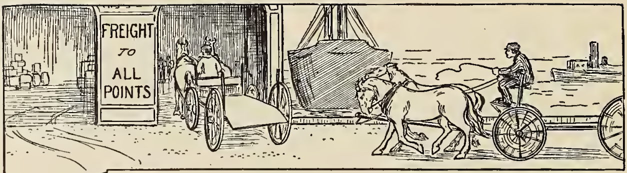
"There is one man," said the teacher, "whose occupation is as important as all these, for we get the products of some of many industries from him."

"Oh! I know," said Mary, "the storekeeper!"

"Yes, but before the goods reach the storekeeper, they have to be taken from the factory to the wholesale warehouse, just as the raw product was taken from the farm to the factory. This leads us to consider the carrier. How are goods carried?"

"In wagons!" said several.

"Yes, ordinary farm products are brought in



wagons directly to the city market. This is especially true of what are called garden vegetables. But some of them are packed in boxes or barrels and sent far away. We get many things from far-distant places ourselves."

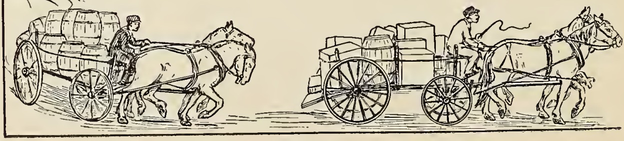
"Yes, I know," said William; "coffee comes in bags, tea comes in boxes, and sugar comes in barrels."

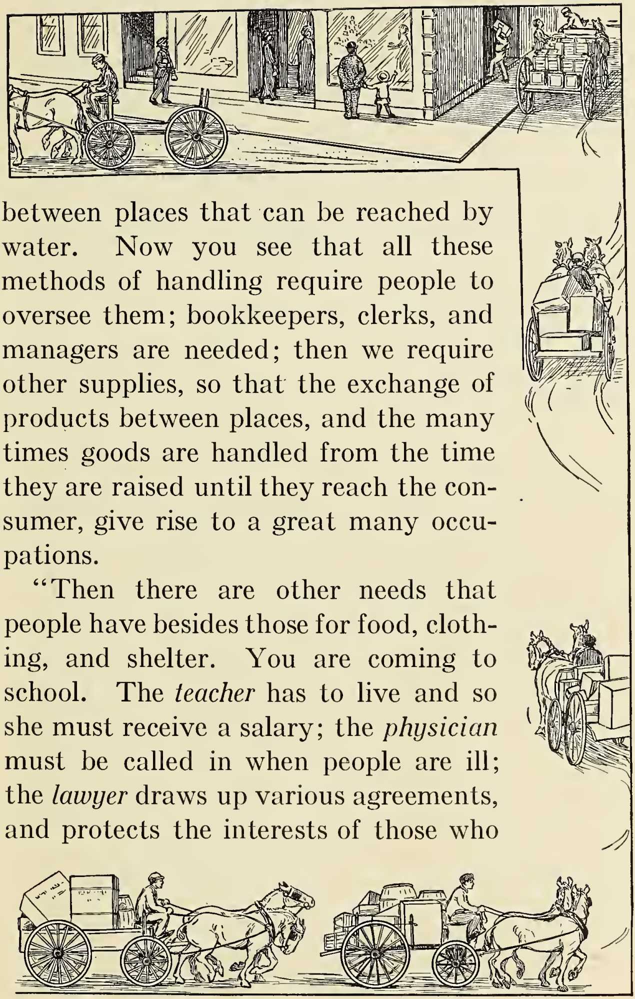
"But what I want you to tell me is how these things get to us and how we send things away," said the teacher.

"By the freight train," said William.

"By the steamboat, too," said Susan.

"The charges on goods sent by train and by steamboat are quite high," said the teacher, "so a cheaper way of transportation has to be found. Goods that will not spoil are sent in sailing-vessels





between places that can be reached by water. Now you see that all these methods of handling require people to oversee them; bookkeepers, clerks, and managers are needed; then we require other supplies, so that the exchange of products between places, and the many times goods are handled from the time they are raised until they reach the consumer, give rise to a great many occupations.

"Then there are other needs that people have besides those for food, clothing, and shelter. You are coming to school. The *teacher* has to live and so she must receive a salary; the *physician* must be called in when people are ill; the *lawyer* draws up various agreements, and protects the interests of those who employ him when they appeal to the law; and the *clergyman* looks after the spiritual needs of the people.

"It will be an interesting thing to think out in a general way the duties that are performed by each trade, profession, or occupation that you can call to mind."

XL. VILLAGES, TOWNS, CITIES

We find that wherever it is possible, men like to live together in villages and towns. This is noticed especially among savages.

Sometimes this is not practicable, because farms or plantations may be so large that the dwellings on adjoining pieces of land may be miles apart. But the owners will travel this distance to enjoy the company of each other.

Moreover, when a country is in an unsettled state, people must live in strongly fortified dwellings or in villages to be safe from enemies.

It is almost a necessity, and certainly a great convenience, for those people who cannot raise on their land all that is required for food, to live where it can be had easily. So for this reason, also, men like to live in villages, towns, or cities when their occupations will permit.

In a village, the number of people is so small that nearly every one knows every one else. In a town, the number of people is much greater, and in a large city, there are so many people that a person may go over the same route every day without meeting the same people twice.

The people who live in cities and towns depend on trade and manufactures for their occupations. There are many towns that have only one large industry, while there are other towns that furnish several industries. There is much suffering in these towns when the factories shut down, as is frequently the case, for then many people are thrown out of work.

In large cities it often happens that when one kind of work becomes dull, work of another kind may be found. But in a city there are usually very many people who have great difficulty in finding work. Nowhere are there so many people as in the cities, and nowhere do poor people suffer so much.

A city has to be governed and protected. This requires officers of various kinds, and large forces of men under them. The police must see that order is preserved in the streets, and that life and property are protected against wicked people. The fire department is called upon to protect property against fire. Schools are established for the children, and hospitals for the sick. Then there are great public works, such as the building of sewers, the paving of streets, the building of bridges and docks, that must be attended to.

All of these things cost money, and the money is raised by taxation. Every person that owns property must pay his taxes; that is, his share of the money needed for the government.

XLI. MONEY

In former times taxes were often paid in skins, in bushels of wheat, or in other products. But since the use of money has become so general, and the business of the government is so great, it is too much trouble to take produce, and money is required instead.

Money is a great convenience. It is the means by which the exchange of one thing for another may be made. If I perform some labor for a farmer, it would be awkward to receive a quantity of oats or hay from him unless I could at once exchange it for something I need. But with the money in my pocket, I can take my time and buy at my pleasure just what I want.

It is the same case when I desire to buy a quantity of goods.

If I had only certain kinds of goods, I could exchange them only with somebody who was in need of my goods.

Various substances have been used as money at different times: the American Indians used coal, bone, shells, agate, gold, silver, copper, iron, and lead. But nearly all civilized people now use only gold, silver, nickel, and copper. These metals are cut into suitable forms and stamped, or *coined*, by the government. In addition to these coins. the government, and some banks that have received permission from the government, issue bank notes, or *orders* for money, which can easily be exchanged for coined money.

So easy is it to exchange these notes, that they are generally paid and received as though they had the value in themselves of the gold or silver which they represent.

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